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VOLUME 14, NUMBER 1 — APRIL 1985

THE
IDRC

Reports



Drugs: essential and harmful

- alley cropping
- chemical hazards
- growth of cities
- moulds and malnutrition



LETTERS

Working together

We recently came across a copy of your publication, *Reports*, and were favourably impressed with the wide range of development topics covered. In our quarterly journal, *Together*, we are also concerned with practically addressing the needs of developing countries. And we believe that the contents of your report could prove useful as a resource for future issues of *Together*.

Konny M. Thompson
Editorial/research
assistant
World Vision International
Monrovia, California,
U.S.A.

Not just bumf

Your monthly review is constantly one of the most well-produced, interesting and provoking publications that we get out here — and believe me we get quite a lot of irrelevant bumf!

Your October issue (*Reports* 13(3)) caught me by its quite stunning cover and by the content on handpumps — as well as by the piece by your Dr Nelly Stromquist. Congratulations.

As you can imagine here, water is a major issue. For my colleague Agricultural Engineer Gerald Robinson (Programme CRED, c/o UNDP, P.O. Box 4595, Maputo) I would like the contact with your technical people who can give us details on the PVC pump and on

how we could get hold of some of them for trial in our CRED Centres.

For your colleague Nelly Stromquist, I would like to hope that she can get down here some day and write up our newly born experience in action-research — or as we call it "participatory research."

Thank you again for *Reports*.

Brian MacCall
Team Leader
Programme CRED
Regional Centres for
Participatory Research
and Development
Maputo, Mozambique

Action-research

This is to thank you for the regularity with which we receive *Informa* and to mention especially Nelly Stromquist's article on action-research in your October issue (*Reports/Informa* 13(3)).

Our institute is currently receiving support from IDRC in doing a study on educational and work prospects for youth in the urban areas of Peru. It is an attempt at a descriptive evaluation of what is involved in incorporating new generations into working life and adulthood in general, and the role played by education in the process.

Dr Stromquist's article has revived my hope of being able to undertake an action-research experiment in the Peruvian Andean communities in the near future. It would be based on experiments

still in the initial stages of communal educational promotion, but which will draw upon the large anthropological experience we have accumulated in the area. It is encouraging to see that our national and research hopes are in accord with the most up-to-date of scientific developmental concerns. This may perhaps be one of the ways of dealing seriously with the violent conditions in the countryside.

Rodolfo Sanchez Garrafa
Director of Research
National Institute for
Educational Research
and Development (INIDE)
Lima, Peru

Reports

THE IDRC

The IDRC Reports and companion editions *Le CRDI Explore* and *El CIID Informa*, about the work of the International Development Research Centre and related activities in the field of international development, are published quarterly and are available on request from the Communications Division, IDRC, P.O. Box 8500, Ottawa, Canada K1G 3H9. *Editor-in-chief:* Rowan Shirkie. *Associate Editor:* Jacques Dupont. *Spanish edition:* Stella de Feferbaum. *Layout:* Alice Herczuk. *Staff photographer:* Neill McKee.

CONTENTS

Letters		2
Essential drugs	Concern grows that unnecessary drugs are becoming an obstacle to health in developing countries. Yojana Sharma reports.	4
A drug on the market	The marketing of pharmaceuticals emerges as a development issue. By Andrew Williams.	7
The nettle grasped	Promoting an indigenous pharmaceutical industry in Bangladesh. By A.B.M. Ghulam Mostafa.	9
The green pharmacy	Nature is still the greatest source of pharmaceuticals — but there are limits, as Margie Nearing explains.	10
The community herbal	Local knowledge and scientific analysis combine to bring low-cost medication to the Philippines. By Michael L. Tan.	12
Cairo: growth of a giant	Guy Parent portrays a city strained by rapid growth.	14
A useful site	Land use planning and housing needs begin to come together in Quito, Ecuador. Wilson Ruiz reports.	17
Trees take to the fields	It may look like jungle, but a new cropping pattern in Africa may prove very productive. By Jean-Marc Fleury.	18
Controlling the chemical threat	A global system tries to assure that chemicals deliver benefits, not risks. By James Mpinga.	20
Mycotoxins	Contaminated food may be a major contributor to malnutrition. Hope Cadieux-Ledoux explains.	23
Briefs		24
New releases		27



Cover: *Pharmaceuticals being manufactured in Bangladesh. Efficacious and essential drugs are critical to health in developing countries, but providing them — and at affordable prices — poses some unusual challenges. See stories beginning page 4.*
Photo: John Flanders

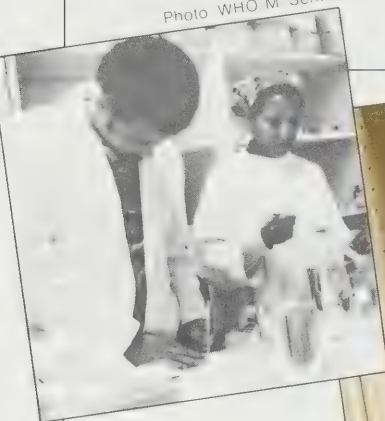
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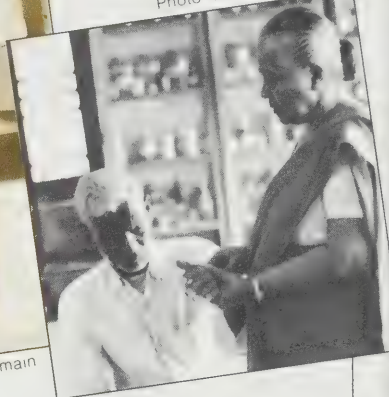


Essential drugs to satisfy the health care needs of the majority of people



Photo WHO/J. German

Photo WHO/P. Harrison



ESSENTIAL DRUGS

YOJANA SHARMA

Although three-quarters of the world's population live in the developing countries, Third World people represent just 15 percent of the world pharmaceutical market. Yet their drug needs far outstrip what they can actually obtain, not only because of the size of the Third World population, but also because of the disease patterns.

Diarrhoeal, parasitic, and infectious diseases, controlled in the developed world by improved living conditions, water and sanitation facilities, and better health services, are still rife in the Third World. Here diarrhoea is the single largest cause of death in children under five, accounting for some 4-6 million deaths a year. An estimated 210-220 million people suffer from malaria, a debilitating disease that saps strength and reduces productivity. Airborne diseases such as tuberculosis and diphtheria are still important causes of death.

The real tragedy is that the vast majority of Third World ailments are treatable and curable with common, cheap, and easily available drugs. Yet these countries will continue to go without the medicines they need because it is purchasing power rather than real health needs that determine who gets the drugs.

Only 12 percent of drug production takes place in the developing countries and not a single developing country can claim to be self-sufficient. They have little choice but to buy the bulk of their drugs from the Western-controlled multinational

drug companies, which control 90 percent of the production and trade in pharmaceuticals.

Such dependence also means these countries are vulnerable to overpricing. Purely arbitrary pricing policies of the multinational drug companies grossly inflate the medicine bill for the countries that can least afford it and deny drugs to those who need them most.

But what is even more worrying is the well-documented evidence that multinational drug companies supply and promote ineffective, inappropriate, and, even downright dangerous, preparations in developing countries, which have few effective controls.

Volunteer health worker in Nepal explains uses of essential drugs



Photo: WHO UNDP T. Farkas

Multivitamins, cough syrups, appetite stimulants and potency drugs are just some of the nonessential drugs that are promoted and consumed at the expense of basic lifesaving drugs. In some developing countries, up to 25 percent of drugs consumed come under these categories. In Nepal, where serious respiratory disease and protein malnutrition are widespread, one-third of the drugs marketed are multivitamin tonics. And in Thailand it was found that consumption of the anti-malarial chloroquine was only 7 percent of the estimated need.

More frightening are the examples of fraudulent and misleading advertising which sometimes can be dangerous. Holland's biggest pharmaceutical manufacturer, Organon International, was brought to task by a Dutch industrial tribunal after a consumerist pressure group found it was promoting anabolic steroids for malnutrition and loss of appetite in countries like Peru, India, Bangladesh, Indonesia, and Kenya. These hormonal preparations can in fact stunt children's growth.

Consumer groups are convinced that these and many other examples they have picked up are just the tip of a huge iceberg, and have been calling for a World Health Organization (WHO) code of conduct to control the activities of the pharmaceutical companies. In 1982 when such a code seemed imminent, it was effectively forestalled at the World Health Assembly in Geneva. The drug manufacturing industry, under the auspices of the Inter-

national Federation of Pharmaceutical Manufacturers Associations (IFPMA), announced its own code of marketing which states, among other things, that manufacturers shall not make claims that cannot be supported scientifically, and that products must have "full regard for the needs of public health." At that time WHO officials felt that industry's own code should be given a chance before WHO drew up a code of conduct of its own.

At the May 1984 World Health Assembly, just two years later, many Third World delegates felt the gaping loopholes in the industry code were already too apparent. Foremost among the reasons for the ineffectiveness of the code, as far as delegates could see, was inadequate monitoring — a problem that sparked off a row at the WHO executive board meeting in January when the United States delegate, backed up by the IFPMA, objected to WHO monitoring the code. WHO officials had been notifying the IFPMA of breaches of the code sighted while on their travels. A U.S. state department official said it was not for WHO to monitor the code of a private organization.

But, as consumer groups vociferously pointed out, there is no way of finding out if action has really been taken by companies brought to order by the industry's code. Systematic monitoring is what is needed as self-policing just does not work. Proof of this is that, apart from WHO, only consumer groups have been submitting complaints to the IFPMA.

With developing countries sceptical of industry's stated intention to prevent wild claims being made about drugs, this year's World Health Assembly agreed to a meeting to be held this year to discuss information on the proper use of drugs and on drug marketing practices. Few delegates doubted that the meeting is the first step towards drafting a WHO code of conduct on the marketing of pharmaceuticals in the Third World.

In the meantime the needs of the Third World are pressing. They cannot wait for industry to prove its sincerity. It is impossible for them to try to counteract the market power of a hundred profit-seeking private enterprises, so they must organize their own buying force if they are to get anything like a fair deal.

The first step is an essential drugs list. A list of 250 essential drugs was drawn up by WHO in 1978. Since then about 80 developing countries have developed their own essential

drugs list based on their own needs and disease patterns and following closely the WHO model list. With some 50 000 branded drugs on the market, this enables developing countries with scarce resources to concentrate on those drugs that they really need and keep the pharmaceutical bill low by shopping around for a limited list of medicines.

This is important in a market where pricing seems to follow few rules. The Algerian Committee Against Tuberculosis did a survey in 1976 and found that isoniazid from a Swiss company cost nine times more than the same drug bought from a French concern. Similarly streptomycin was four-and-a-half times more expensive in France than in Mexico. Even within the same company there seems to be little pricing logic. In 1980 Mozambique's central drug buying agency, Medimoc, studied the market for the drug furosemide. One company offered it for US\$150 for a thousand tablets in one location and purveyed it elsewhere for US\$36 per thousand. Doing the rounds of other companies, Medimoc eventually procured furosemide at US\$8 per thousand tablets.

But this kind of shopping around, which is the basis of a country's bargaining power, depends on a thorough knowledge of the pharmaceutical market that many smaller developing countries lack. WHO therefore promotes pool procurement of essential drugs by several countries within a region. The Gulf states, for instance, have been pooling resources since 1978 and regularly save 25 percent of their total pharmaceutical bill in this way.

But for most countries pooled procurement is still a long way off. Even the hospital sector, the military, social security systems and other government departments still buy their medicines independently of each other, and these countries miss out on the opportunity to get lower prices.

UNICEF has been successful in getting low prices for bulk orders. In 1983 a system of international tender for about 40 essential drugs for Tanzania was tried out as a test case. Tanzania called for bids for a 3-year supply of drugs; financing was assured by Danish development aid. Competition was fierce among the 120 companies that participated in the bidding. WHO described the prices obtained as the lowest ever seen for essential drugs.



Photo: WHO/UNDP T. Fairkas

The basics: drug kits for remote areas

But even these successes are limited, as there are few countries that can find the foreign exchange that the UNICEF scheme requires in advance. Some least-developed African countries only have enough foreign exchange reserves to meet all their import needs for only two months ahead. Buying drugs for a 3-year period, even if it means considerable savings, is out of the question.

This does not daunt either UNICEF or WHO. The possibility of accepting partial payment in local currency is being explored. And a US\$5 million joint UNICEF/WHO trust fund has been proposed to help bulk procurement of essential drugs. If approved, the scheme could nudge more countries into starting essential drugs programs as these will be able to draw on the fund first.

Ironically, apart from UNICEF and WHO, poor countries have a third option when they want help with essential drugs, particularly distribution, storage, and training of personnel in the drug chain. At the 1982 World Health Assembly, the IFPMA agreed not only to supply a range of essential drugs under "favourable conditions" to underdeveloped countries, but also to help African countries with distribution. The move was seen as an attempt to improve industry's tarnished image.

But a WHO paper reports that no country has so far been able to receive drugs under "favourable conditions" according to the IFPMA offer. WHO estimates that at most the drug industry has contributed

about US\$1 million worth for WHO's anti-malarial program and for a few bilateral schemes with African countries that are only marginally connected with WHO's essential drugs program, if at all.

The pharmaceutical industry is quick to point to its assistance to Gambia as an example of how it is helping developing countries with drug distribution. But one WHO official has described the program as the "biggest case of overkill seen in an African country." The sum of US\$160 000 has been donated by 13 U.S. companies to develop distribution channels for drugs in Gambia, which has a population of only 650 000. The largest amounts, of some \$17 000 each, were donated by huge billion-dollar multinationals like Eli Lilly, Johnson and Johnson, Pfizer, Schering Plough, Searle, Smith, Kline and Syntex. As Dr Ernst Lauridsen of WHO's essential drugs program has remarked, these initiatives, however welcome, must be seen in the context of the sums spent by drug companies on the promotion of their drugs — usually 10-20 percent of turnover.

Another pilot project, with the Swiss pharmaceutical industry, intended to improve distribution of drugs in the central African state of Burundi is being carried out in collaboration with WHO. Hoffman la Roche, Ciba-Geigy, and Sandoz have put up \$30 000 between them to improve access of the 4.5 million population to drugs. But the Burundi project too has been attacked as simply a public relations exercise.

However, the Burundi health ministry officials do not accept the criticism, and seem genuinely appreciative of the initiative. Paul Mpitabakana, a health ministry official, expressed the real predicament of poor countries in his comment on accepting the industry offer: "We cannot do things by ourselves," he said. "We need help. And if someone comes to us offering that help, well, of course we take it; it is better than nothing." □

Yojana Sharma is a Brussels-based journalist specializing in Third World affairs.

Local resources for low-cost drugs



Photo: WHO/A. S. Kuchner



CANADA

BY ANY OTHER NAME...

Third World countries are not alone in finding themselves embroiled in a debate about the higher costs of brand name drugs over their "essential" or generic counterparts. The Pharmaceutical Manufacturers' Association of Canada (PMAC) is pressuring the Canadian government to reverse a 1969 change to the Patent Act that permits companies operating in Canada to import the ingredients to make generic copies of brand name drugs by paying the patent holder, or investing company, a four percent royalty.

In submissions to a federal commission investigating the issue, PMAC claimed that the practice of compulsory licensing, as it is called, does not allow the 66 multinational companies PMAC represents to have a sufficiently long period of exclusive access to the market for new drugs they produce. The generic firms are being allowed to manufacture under license within four or five years of the brand name drug's entrance onto the market: the pharmaceutical multinationals claim that this is not sufficient time to recover the investment in research needed to develop the drug.

Consumer groups such as the National Anti-Poverty Coalition claim that the 15 year-old amendment to the Patent Act has saved Canadians — particularly poor ones — millions of dollars a year. They say that consumers save CA\$130 million a year directly and that an additional CA\$140 million is saved by taxpayers in lower costs for provincial plans that provide prescription drugs to the poor.

The Canadian Drug Manufacturers' Association (CDMA), which represents a dozen Canadian-owned companies that make generic drugs, wants the federal inquiry to recommend a continuation of the present licensing practices. As a compromise, to encourage research

and development of new drugs in Canada, the association would accept the granting of a 5-year patent for pharmaceutical products invented, patented, and manufactured completely in Canada.

CDMA claims that competition between generic and brand name drugs keeps prices down and that the pharmaceutical companies make enough profit to recoup their investments. Prior to the 1969 legislation, Canadians were paying amongst the highest prices in the world for drugs. The success of the changes in licensing in lowering prices of drugs for Canadians has prompted other countries to approach CDMA and to inquire about following Canada's lead in this area.

The multinational companies' claim that compulsory licensing has reduced their profits and ability to develop new drugs is not supported by the facts, Lawson Hunter, director of investigation at the bureau of competition policy in Consumer and Corporate Affairs, told the inquiry. Mr Hunter said that virtually all research of new drugs is done in the home country of the parent company and the overall cost of research represents only 3.8 percent of the international sales of the pharmaceutical industry.

"The fact that compulsory licensing was done away with would not be likely to increase the pharmaceutical companies' commitment to research and development in Canada," he said.

Mr Lawson pointed out that the drug companies' profits in Canada have improved, or, at worst, remained unchanged since 1969. He felt that the companies were lobbying against compulsory licensing in Canada because if other countries that now have full patent protection adopted similar patent policies this would cut into the companies' international profits.

ANDREW WILLIAMS

The international proliferation of drugs — more than 10 000 prescription and over 100 000 non-prescription drugs — instead of being a boon, has created major problems for developing countries which cannot regulate their quality, sale, or distribution.

As a result many drugs sold in the Third World are unnecessary, useless, or harmful. Critics of the pharmaceutical industry have claimed that drugs are being sold for purposes for which they are not intended or without adequate warnings about possible serious, and sometimes fatal, side effects. Massive expenditures on advertising are the cause of poor people's attitude that there must be "a curative pill for every ill" and of their spending scarce money on vitamins or tonics, rather than on food, when they are seriously ill. The high price of brand name drugs in a market dominated by foreign corporations is a major drain on the health care programs of developing nations and seriously hurts their ability to improve the overall distribution of health care.

Unable to afford the cost of monitoring the practices of the drug companies, many governments in the Third World rely on the industry for information about drug usage, precautions, or side effects. Critics claim, however, that the result has been overpricing, the "dumping" of drugs not approved in their countries of origin, misleading advertising, high-pressure marketing techniques directed at doctors and pharmacists, and a double standard of information accompanying the drugs.

The drug companies have attempted to answer these criticisms voiced by advocacy groups and the World Health Organization (WHO) by saying that they are responding to different government's requirements and to market conditions, and are not intentionally misleading users of their drugs. The corporations claim that the difference between the information accompanying the drugs in developed and developing countries is a result of licensing conditions for the drug in Europe or North America. Leaflets distributed to doctors adequately warn of side effects and proper usage, they say, and advertisements and labels are monitored by the industry for errors. They defend the much higher prices of brand name drugs over their generic counterparts as necessary to sup-

A DRUG ON THE MARKET

CONTROLLING PHARMACEUTICALS IN DEVELOPING COUNTRIES



Photo: WHO/Oxfam



Dangerous dispensing: drugs are widely available but little understood

port the research carried on by the pharmaceutical corporations.

On the other hand, one company, Ciba-Geigy in Switzerland, is marketing about 30 of the drugs on the WHO's list of 200 essential drugs, through a subsidiary, Servipharma, which sells them at costs similar to the generic products. The International Federation of Pharmaceutical Manufacturers Associations (IFPMA) has itself drafted a code of the obligations of the industry, which also suggests the companies are sensitive to criticisms about their conduct in the Third World, especially since it will represent 40 percent of their business by 2000, according to one estimate.

One example of the importance of this market is Malaysia; a 1980 report suggested that Malaysia could be the

market with the greatest potential drug sales in Southeast Asia. The total sale in pharmaceuticals in Malaysia in 1978 was estimated to be M\$140 million (US\$64.3 million) an increase of about 20 percent over the previous year, according to an industry representative. The total drug sales for 1983 were projected to be M\$196 million (US\$90.2 million).

The absence of a national drug policy in Malaysia has led to many of the problems associated with an unregulated sale of pharmaceuticals in other developing countries, according to the Consumers' Association of Penang (CAP), a consumer advocacy group based in Penang, Malaysia. The proliferation of dangerous and unnecessary drug products poses a threat to the health of consumers

and is a tremendous drain of foreign exchange on the country.

CAP mounted a study of the marketing practices of some of the 70 multinational pharmaceutical corporations operating in Malaysia. With financial assistance from IDRC, the study examined 22 drugs — 5 antibiotics, 6 painkillers, 4 anti-diarrhoeal agents, and 7 miscellaneous drugs — which are widely used in Malaysia, registered or restricted in their countries of origin, and have a history of problems of marketing or usage in the Third World.

Preliminary results have been released by CAP on the marketing and usage of two anti-arthritis painkillers, phenylbutazone and oxyphenbutazone, drugs that have caused several thousand deaths and serious side effects worldwide. Despite being banned or restricted in many developed countries, the drugs were still being actively marketed in the Third World, and widely prescribed by doctors apparently ill-informed about their toxicity. The situation is made worse by the companies' different standards in labelling and marketing their products in developing countries.

The two drugs, phenylbutazone and oxyphenbutazone, have recently been withdrawn or severely restricted in Europe and the U.S.A. as they have been linked with life-threatening blood disorders, gastrointestinal bleeding, ulceration, leukaemia, and the Steven-Johnson Syndrome. Nearly 1200 people worldwide have died from these drug-related disorders, according to a leaked internal report from Ciba-Giegy, the largest producer of the painkillers. Over 10 000 persons have also been reported to have suffered serious side effects.

Following the leaking of the Ciba-Giegy document, early in 1984, many governments moved to ban or heavily restrict the use of these drugs. In Britain, where at least 1500 patients are estimated to have died in the last 25 years from receiving the drugs, the government banned phenylbutazone from general use and the company voluntarily withdrew oxyphenbutazone soon after.

The two drugs have also been banned in Norway, and in Bangladesh, a developing country which, unlike Malaysia, has a drug control ordinance to regulate the manufacture, import, distribution, and sale of pharmaceuticals. The new information about the harmful side effects of the painkillers does not seem to



Shedding nails caused by an anti-arthritis painkiller: one of the inappropriate side effects of drug marketing and prescribing

be well known in other developing countries, where they continue to be widely used, with possible adverse consequences.

The failure of the drug companies to adequately warn consumers and doctors in the Third World against using the drugs for minor ailments or for treatment of the young and elderly is evidence of a "double standard" in marketing, concludes CAP. In the developed countries, the companies recommend the painkillers only for short-term treatment of acute and severe rheumatic disorders and acute gout. The same companies recommend the drugs for minor ailments in Third World countries, however. For example, in Malaysia, they are recommended for "pain and stiffness in muscles and joints, lumbago, tension headache," and for "long-term treatment." In the United States, the Physicians' Desk Reference warns that the Tanderil brand of oxyphenbutazone should not be given to children below the age of 14; however, in Malaysia, the drug insert for the same brand recommends its use for children from the age of 12 months onwards, the CAP study shows.

The two drugs are widely prescribed by Malaysian doctors even for such minor ailments as headaches and stomachaches. This use was disturbing, said CAP, because the toxic side effects of phenylbutazone are common and occur in 25 to 40 percent of users. According to the Ciba-Giegy memorandum, 20 out of 100 patients using phenylbutazone and 7 out of 100 patients using oxyphenbutazone are affected. Despite this knowledge, the Drug Index for Malaysia and Singapore listed 18 brands of phenylbutazone and 6 brands of oxyphenbutazone sold in Malaysia.

The case of a Malaysia university lecturer was referred to by CAP in its study. He almost died when his doctor gave him phenylbutazone to treat a stiff neck. He suffered from rashes which later erupted, leaving raw flesh, and the tissues of his eyes and his nails dropped away. Another physician diagnosed his condition as Steven-Johnson Syndrome, a reaction to the drug, and gave him only a 50 per-

cent chance of survival. Fortunately, he recovered, after a three-week stay in hospital.

CAP also pointed out that there are safer alternatives, such as paracetamol, salicylates such as aspirin, and non-salicylates like indomethacin, to phenylbutazone and oxyphenbutazone for minor ailments. Although some of these drugs also have serious side-effects, they are not as toxic as the two pain-

killers in question.

When CAP released the report, it requested the Ministry of Health in Malaysia to ban the two drugs. The Malaysian Medical Association supported CAP's request and its president said that both drugs "should not be allowed into the country and should not be made available to people, even with a prescription." The report created quite a controversy in the medical community, however, and a number of doctors and pharmacists defended the use of the drugs, despite their side effects.

The controversy surrounding the marketing and use of these two painkillers adds ammunition to CAP's memorandum to the Malaysian government several months earlier that suggested that it follow Bangladesh's lead in implementing a national drug policy and in adopting the WHO list of essential drugs.

By implementing unified legislative and administrative control, CAP argues, the government could provide Malaysians with the widest coverage of the most relevant drugs at the minimum cost. By encouraging local manufacture of essential drugs in bulk, the government could promote self-reliance and halt the exodus of foreign exchange, as Indonesia has done through the local manufacture of aspirin, paracetamol, and tetracycline.

The problems described in the CAP study and its recommendations underline the significance of the resolution taken at the United Nations World Health Assembly in May of 1984. It called for unbiased and complete drug information to be made available to developing countries and for better monitoring of the marketing practices of drug companies and the prescribing practices of doctors to be implemented. Only through a rational drug policy can Third World countries ensure that the benefits of drug treatment are provided, safely and cheaply, to all their citizens. □

Andrew Williams is an Ottawa-based communications consultant specializing in Third World issues.

A.B.M. GHULAM MOSTAFA

THE NETTLE GRASPED

Bangladesh's New Drug Policy caused a great stir when it was announced in 1982. Three years later, essential drugs manufacture and national production have increased, the country depends less on imports, and prices have fallen.

The provision of essential drugs is an important element of primary health care in Bangladesh. But the pattern of drug production in the country and government policy in this respect were not conducive to achieving this objective. On one hand, production of essential drugs was far below the country's requirements. On the other, about one-third of the money spent on drug production was devoted to as many as 4000 useless and unnecessary items. Medicines were marketed mostly under brand names; due to this, the import policy on pharmaceutical raw materials could not be controlled, causing a high retail price of drugs. The government was spending a huge amount of foreign exchange, but the benefit from it did not go to the poor consumers.

This was the scenario when the New Drug Policy was announced. The policy is based on six precepts: the elimination of harmful and useless medicines; increased domestic production of essential drugs; a public distribution system of essential drugs; bulk importation of pharmaceutical raw materials from different sources at competitive prices; the use of generics rather than brand names; and the encouragement of locally organized, applied drug research.

The essential feature of the New Drug Policy is that all drugs and medicines are considered to need fresh evaluation by a committee of experts on the basis of guidelines framed for the purpose. The New Drug Policy prohibits manufacturers from combining an antibiotic with another antibiotic, an analgesic with another, and a vitamin with another, and from using codeine in any combination. The manufacture and importation of cough

mixtures, throat lozenges, tonics, and other products of little therapeutic value are banned. Various steps have been taken to encourage and protect local drug manufacture such as banning the importation or production by subsidiaries of drugs that are being manufactured by Bangladeshi companies.

The New Drug Policy has greatly benefited the people of Bangladesh: It has developed self-reliance and bolstered the country's confidence. There used to be around 4000 drugs available and of these, 1700 items were

tration was given to 150 drugs; this figure came down to 55 in 1984. The import bill for finished drugs is also decreasing, as the demand is being met by continuously increasing local production. Total import value of drugs stood at *taka* 200 million (about US\$8 million) in 1983, as against *taka* 240 million (about US\$10 million) in 1982.

The production of essential drugs has increased considerably. In 1982, it was worth *taka* 990 million (about US\$40 million), whereas it rose to the level of *taka* 1360 (about US\$55 million) during 1983, an increase of 36 percent.

The policy has also helped reduce prices, since it has introduced the system of importing raw materials from different sources at competitive prices. Previously, many raw materials used to be imported at an exorbitant price from parent sources only. For instance, tetracycline, previously imported at US\$102 per kilo, was obtained at US\$27/kg; ampicillin previously costing US\$82/kg was obtained at US\$65/kg.

These commonly used drugs are now, for all practical purposes, cheaper than before. The same applies to many other products for which competitive price sources are available. Increase in price, where it has occurred, has been rather reasonable. An important and beneficial side-effect of the drug policy has been to curb the bad practice of over-prescription by doctors and health workers, by reducing the availability of some formerly rather popular items.

The drug policy is a step in the right direction in meeting the medical needs of the ordinary person in Bangladesh. Many countries in the Third World are watching Bangladesh's lead in this area, and some may soon follow suit themselves. □



Manufacturing drugs in Bangladesh: self-sufficiency

either useless or harmful. Now the production and sale of these drugs has been prohibited.

A list of 150 essential drugs has been identified to serve most therapeutic purposes. Of these, 12 drugs have been selected for use by the rural village health workers for the most common diseases and another 45 for primary health care at the Upazila Health Complexes. Another 100 drugs of a specialized nature have been selected for use in complicated cases.

The policy has helped to increase production of drugs and medicines within the country. In 1981, the local production of drugs was worth about *taka* 1500 million (about US\$ 60 million), of which one-third were not essential. Local production has now shot up to *taka* 2500 million (about US\$101 million).

Dependence on imported drugs has decreased, leading to better use of resources. During the period from June 1981 to June 1982, import regis-

A.B.M. Ghulam Mostafa is Secretary for the Ministry of Health and Population Control, Government of Bangladesh. This article is an edited version of a longer piece that appeared in World Health, the magazine of WHO.



Medicinal plants being sold in Bolivia: a natural resource

THE GREEN PHARMACY

HERBAL MEDICINES IN MODERN USAGE

MARGIE NEARING

Near the Juma Masjed Mosque in Old Delhi, a herbalist sits on a cloth under his umbrella expounding the benefits of his craft. Surrounding him are a variety of bottles and vials. A crowd has gathered, women dressed in saris, men in cotton pants and long shirts. A few tourists look sceptically at the merchant's wares.

Although it is highly unlikely that any of the tourists will try his potions, feeling more comfortable with their

modern medicines, many of the others will seek his cures.

For this herbalist is not a romantic relic of an unsophisticated past. He is one of about half-a-million traditional healers who provide medical care to close to two-thirds of India's population. And indeed, chemists and pharmacologists are finding that herbalists, witch doctors, and medicine men can provide important clues leading to new drugs for modern pharmacies.

Despite remarkable progress in laboratory drug development, the earth's flora and fauna are still the most important source for potential drugs. The natural pharmacopoeia has thousands of plants to choose from, yet most of them have never been thoroughly analyzed with modern techniques.

Traditional healers and pharmacists, such as the Indian herbalist, can provide important information needed to determine which plants deserve to be taken into the laboratory for further analysis. In Brazil, where the flora of the Amazon region has been estimated at 73 000 species, scientists are focusing their studies on the 1300 species that folklore has identified as poisons, narcotics, or local medicines.

The process of deriving drugs from plant sources is not new. Over the centuries people have depended on the materials around them and through trial and error have learned the special properties of the plants in their environment. This knowledge gradually became incorporated and systematized as part of modern medicine.

In 1775, for instance, an English country doctor found that one of his patients improved after treatment with a "secret herbal remedy." Following up on this information, Dr William Withering discovered digoxin in the long, green leaves of the common Foxglove.

Digoxin continues to be a leading treatment for heart failure. It strengthens and improves the tone of the heart muscle, regulating the blood flow and bringing about a slower but stronger heartbeat. In the United States alone more than three million cardiac sufferers still routinely take digoxin.

A more recent example of the importance of traditional plant knowledge was the isolation of muscle-relaxing alkaloids from a lethal compound used as an arrow poison by numerous South American Indian tribes. Curare acts by paralyzing the victim and kills by asphyxiation when paralysis reaches the respiratory muscles. Identification of curare's active components, such as strychnine, in the 1930s opened the way for both natural and synthetic preparations that work with anesthetics and other medications to permit difficult operations and ease convulsive spasms.

Current renewed interest in traditional techniques has developed in a world where traditions are rapidly changing and plant species, especially in tropical areas, are disappearing. This threat of extinction sets a natural deadline for scientists to learn as much as possible before old remedies are forgotten, or their raw materials destroyed.

But the preserving of traditional knowledge is a complex task. It re-

quires observation and recording of medical techniques, identification of plant materials, and experimental investigation of the ingredients and the effects. It is not enough for an anthropologist to report in detail on a ceremony, such as an African poison ordeal. He/she must also record the plants used to concoct the poison and, if possible, the important chemical components.

A multidisciplinary approach to traditional medicaments called ethnopharmacology involves collaborations between anthropologists, botanists, chemists and pharmacologists. An ethnopharmacologist's success in unraveling the chemistry of a herbal tea or poultice often depends on earning the trust of local experts.

In East Africa, "Bwana mganga", village medicine men, are revealing their secrets to Isao Kubl of the University of California at Berkeley (U.S.A.). Kubo learned that a tonic brewed from the orange berries of a local shrub is used to prevent cholera and as a tonic for pregnant women. Testing the antibacterial activity of the shrub extracts, he found maesanin, a substance that blocks the chemical activity vital to cell growth in bacteria. This compound may prove to be a useful model for new antibiotics.

Kubo's promising results are not an isolated example. In the Amazon jungles, a chemist from the University of Sao Paulo, Brazil, found that Indians used the leaves, bark, and blood-red resin of certain trees of the nutmeg family in plasters for skin treatment and to wash infected wounds. Otto R. Gottlieb discovered that the wound-healing power of the plants came from chemicals called ptercarpans. Some of these compounds are undergoing further study to evaluate their antifungal activity.

In one of a number of international initiatives to aid researchers in sorting the enormous amounts of data gathered on plant materials, information is being stored on a central computer system in the United States. Dr Norman Farnsworth of the University of Illinois has entered information on thousands of plants and other natural products and has listed their biological activities against specific diseases such as asthma, diabetes, and hepatitis. He has also assembled records on more than 3000 plant species used to regulate human fertility.

Dr Farnsworth's information is not just of interest to researchers and large pharmaceutical companies. Ethnopharmacology can also be an important element of a developing nation's medical and economic system.

Already, Third World countries are providing many of the raw materials needed in drug manufacturing, but they are not always receiving the

ONLY IN CANADA, YOU SAY?

Investigation of herbal remedies is not restricted to tropical or exotic areas of the world. In Canada's maritime provinces, Frank Chandler, a professor at Dalhousie University in Halifax, studies plants used by the Micmac Indians for biologically active compounds.

Chandler has found that many of the Micmac's herbal remedies were based on sound medical and scientific logic. For instance, they brewed wild cherry bark, an ingredient still used in some cough remedies, for treatment of coughs and colds. The Micmacs also used plants containing volatile oils that have been found to have antiseptic properties.

For most of his 16 years of re-

search, Chandler has used local plant materials, such as sweet fern and bunchberry, but for the past year he has been studying a new laboratory method — cell-tissue culture. This technique uses the cells which produce the chemical compound being studied rather than the whole plant. Advantages are that only a small amount of plant material is needed and that a year-round supply of active components can be manufactured in the laboratory. This can be especially important for studies on rare species, such as the pink lady's slipper, which Chandler is investigating for its anesthetic properties.

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benefits. Medicinal plants are being exported to developed countries where they are screened, analyzed and used in drug preparations — only to be returned as high-priced medicines. Dr Halfdan Mahler, Director-General of the World Health Organization (WHO), has described this imbalance as "drug colonization."

A striking example of this is the development of hormonal contraceptives from diosinin, the active ingredient extracted from *Dioscorea* — a wild yam. *Dioscorea* grows in many parts of Asia and in India is collected for two major American drug manufacturers. Their factories, in Kashmir and Southern India, extract chemical intermediates from the *Dioscorea* that are exported to the U.S.A. and Europe for further processing into contraceptive pills. Some of these pills are returned to markets in India.

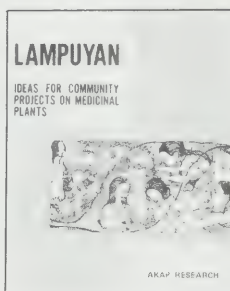
Heavy collecting of *Dioscorea* for local and foreign use has led to another major problem — stock depletion. Because of the small concentrations that many active ingredients are found in, it often takes a large volume of plant material to produce a minute amount of useful product. For example, it requires 11-14 tonnes of Madagascar periwinkle leaves to make just 30 grams of vincristine sulfate, an alkaloid used in treatment of childhood leukaemia and Hodgkin's disease.

Over-harvesting is threatening a number of species, and as more plants are needed for large-scale production, the danger of extinction increases. One solution is to use natural products as models for synthetic drugs. However, chemists have as yet been unable to reproduce the complex structure of a number of compounds such as vincristine.

But for people in developing countries, isolating active ingredients and putting them in modern pharmaceutical forms may not be as important as standardizing dosage, warning of harmful side effects or providing simple yet effective remedies of the natural medicines as they exist. And although it has been argued that because of the potential hazards traditional medicines pose, they should be put through the same pharmacologic trials as other drugs, these tests are very expensive. The danger is that the major advantages of traditional medicine use, low cost and easy access, may be lost in commercialization.

The strategic role of traditional medicine in health care has been stressed by the World Health Organization. Part of the aim of "health for all" by the year 2000 is to urge Third World governments not to rely exclusively on Western medicine or physicians but rather to aim at synthesis between the best of both worlds — modern and traditional. To determine the correct balance, co-ordinated research into folk traditions, plant species, growing conditions and local medical needs is necessary. Most importantly, extraction and processing must be carried out, as much as possible, in developing countries. The health of the people of those countries is too precious — and too threatened — to neglect any resource that could be used to protect them. □

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The use of herbal remedies has become more than an alternative medicine for many Philippine families, it may be the only source of medical drugs to growing numbers who cannot afford expensive pharmaceuticals. The low annual per capita expenditure for drugs in the Philippines — about 80 pesos (about CA\$5) — is at once revealing and misleading. The figure represents an average between high-income families, which may spend thousands of pesos, and low-income families, who may never be inside a drugstore. Drug industry figures further show that the majority of sales are in the capital of Manila, where only 15 percent of the population lives.

The high cost of drugs obviously limits their accessibility to those few Filipinos who can afford them. Because 95 percent of the raw materials used in drug manufacturing are imported and the Filipino peso is being constantly devalued, customers have been faced with price increases on the order of 300 percent a year (1984). Drug sales have fallen as a result.

The Philippine Ministry of Health

slowed the application of the research. Thus, only nine medicinal plants have reached the stage of clinical trials and the formulary lists mainly aromatic plants, whose medicinal use is the relief of minor symptomatic ailments such as fevers and coughs.

Nongovernmental organizations involved in primary health care have tried to help speed up the process. In the early 1970s, some began to develop community-based health programs (CBHPs), mainly through the training of paramedics in rural communities. Traditional medicine was soon identified as a priority area for research, particularly as a means of developing more self-reliance in health care. It was not popular then to advocate the training of village health workers or the use of traditional medicine, and it took the World Health Organization's endorsement of primary health care and traditional medicine in the late 1970s to make the nongovernmental programs more acceptable.

Today, the CBHP network includes such nationally based organizations as AKAP and the Council for Primary Health Care and Rural Missionaries, which coordinate the various regional and local programs throughout the country. These agencies and programs work on a common premise, that the development of medicinal plant usage must start with communities, where the real expertise lies.

Ongoing research on the traditional medical system in the Philippines suggests that each of the 42 000 *barangays* (the basic political unit) has at least one *arbolaryo* or herbalist. Moreover, the herbalists do not have a monopoly on the knowledge about medicinal plants — many Filipinos in rural areas are familiar with a few household herbal remedies and often grow them in their backyards.

There is an extensive marketing system for medicinal plants. Villagers in remote areas of the northern mountain provinces gather medicinal plants and distribute these to vendors throughout the country, as far as the island of Mindanao at the southern end of the Philippines. The *poblacion* (town centre) markets, even in Manila, inevitably have herbal vendors who offer fresh plants as well as packaged preparations, complete with trademarks. In the shadow of an old Catholic church and a Mercury drugstore, in Manila, these vendors offer everything from abortifacients (to "restore menstruation") to vermifuges (to rid worm infestations).

There is an astounding variety of medicinal plants in the Philippines. AKAP has been able to list 1297

THE COMMUNITY HERBAL

TAPPING MEDICINAL PLANTS IN THE PHILIPPINES

MICHAEL L. TAN

has responded by encouraging research on the medical properties of plants and by setting up factories to produce tablet and ointment preparations from the herbs. Preparations such as "Davagesic" and "Davarrhea" are becoming common household items. A Philippine national formulary has been published, endorsing 33 local medicinal plants.

However, lack of funds have limited the government agencies' efforts to develop medicinal plants, and centralized bureaucracies have

plants in the Philippines cited as having folk medicinal uses, the most commonly used ones numbering about a hundred.

It is therefore almost facetious to say that we need to "promote" or "teach" the use of medicinal plants—especially among rural villagers who have been using them for centuries. What needs to be done is to systematize these uses, to share and broaden regional experiences, and to research the scientific basis of folk uses.

Unlike countries such as China and India, the Philippines never developed a "scholarly" tradition in medicine, so one must rely on oral traditions.

Such traditions are tapped in training sessions, where villagers are asked to gather the plants they use as medicine, and to group these according to folk uses. Once this is done, it is easy for trained staffers to explain the medicinal plants' pharmacological action, using terms from western medicine and the idea of chemicals while relating these to local concepts.

For example, the plants commonly used for coughs are almost always aromatics: villagers learn to associate the idea of aromatic qualities with the presence of volatile oils, chemicals that are effective expectorants.

Villagers are also aware that many astringent-tasting plants are useful for diarrhoeas and wounds. The two apparently diverse uses become rational when the concept of "tannin" is explained, since tannins react with proteins, hardening the stool in diarrhoea and reducing bleeding to promote wound healing. The tannins give the plants their astringent taste.

Introducing concepts of "chemicals" helps in developing a more scientific approach towards the uses of the plants. It becomes easier to explain why certain "hot" plants (e.g. red pepper) are helpful for "cold" ailments like rheumatism, or why certain bitter plants (often alkaloid-rich) need to be used with caution.

The efforts to develop a "folk pharmacognosy" grew out of the idea that science can and must develop at the grass roots level. A cookbook approach, where five or six plants are enumerated for a particular illness, has its limitations, because people tend to apply such prescriptive knowledge mechanically, if not magically.

Much debate, in fact, continues on what constitutes "superstition". Certainly, CBHP staffers know that little separates empiricism from magico-religious beliefs and practices. Principles of imitative magic still determine many folk uses of plants

— for instance, plant dosages are often based on numbers with magical or religious significance.

At the same time, community health personnel are aware that modern superstitions also exist, attributing health care to the use of drugs alone, so they try to demystify the use of drugs, whether from nature or from the *botika* or drugstore. For instance, the use of drugs of any kind is discouraged in diarrhoea unless it is clearly of infectious origins. Instead, the use of oral rehydration preparations is emphasized in CBHP programs. Similarly, the importance of nutrition as both a preventive and curative measure is underscored by explaining that many medicinal plants are "medicinal" because they are in fact food plants which provide vital nutrients.

Another example of the demystification process is the community projects to produce herbal preparations such as "SLK Cough Syrup" (made out of tamarind leaves, ginger root and lime juice). The "recipe" is of folk origin and first received attention after a hospital-affiliated CBHP in the central Philippines began

At present, CBHP agencies are studying the feasibility of villagers conducting their own "clinical" studies, monitoring local uses of the plants and the effectivity of these uses through systematic records.

All these experiences are being documented and disseminated as health education materials adapted to different levels (e.g. health professionals, social workers, grass roots communities). The work has been challenging and fulfilling, but few CBHP staffers entertain illusions about medicinal plants solving all the health problems of Filipinos. Infectious disease, mainly respiratory and gastrointestinal, still accounts for about 40 percent of total deaths in the country, and crude herbal preparations will not suffice for such diseases. The needed anti-infectives will still have to come from the *botika* — if the patient can afford them.

Ultimately, discussions about medicinal plants must include an analysis of the economic and political reasons for high drug prices and for the causes of ill



Folk medicine is extensively marketed in the Philippines: refining existing knowledge

encouraging villagers to produce the syrup in bulk, which the hospital itself prescribed. Expenditures on drugs are therefore reduced through communal efforts. But more importantly, the communities are regaining a sense of control over the demystified cures to their illnesses and are developing their own methods of processing medicinal plants. Tablets, ointments, cataplasms (plasters or poultices), syrups and tinctures are produced with local materials such as honey, rice starch, coconut oil or even *basi*, a popular alcoholic beverage. In other villages, the new concepts of doses have stimulated communities to improvise weighing scales out of bamboo materials, with coins used as weights.

health itself. Thus, while it is encouraging to see communities developing "herbal songs" explaining uses and preparations of medicinal plants, it is also disheartening to hear passages such as the following (translated) lines from a popular primary health care song: "Follow the doctor's orders if you are sick/Mercury (drugstore) has the medicine/But my pocket's empty/Must I pawn my wife?" □

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CAIRO: GROWTH OF A GIANT



Photo: Guy Parent

With its nine million inhabitants, Cairo is the virtual metropolis of Africa. Grappling with the secondary results of phenomenal demographic growth, Cairo is also an overpopulated city. Three million people enter and leave the Egyptian capital every day, bringing its daytime population up to more than 12 million.

The city comes alive at the first flush of dawn. People flood into the centre from all the outlying suburbs. Buses, jam-packed by the time they leave the periphery, do not even bother to stop as they approach the city centre. People get on and off buses however they can, which means by running after them. The terminus at Tahrir Square in the heart of Cairo takes on the appearance of a fair to a foreigner. Pedestrians, cars, buses and trucks are all jumbled into a whirligig.

However, there are very few accidents. Cairenes are excellent drivers and they seem to have developed a sixth sense at the wheel of their cars, as if being shut into them for hours on end had taught them new dimensions of

GUY PARENT

patience and resignation. One very rarely sees anyone behave in an aggressive way or lose their temper.

What is tiring is that the city has not banned the use of horns. The result is an increasing cacophony of beeps, bleats, and blasts unrivalled in any of the world's great cities.

"But it's always like that," says Gamal, an official at the Ministry of Agriculture, who drives a taxi outside office hours. "Besides, there's the construction work on the subway!"

The famous subway, which even the greatest optimists do not expect will be running before 1988, should at least make it possible to decrease the downtown traffic a little. "But the construction work isn't going fast," says Gamal. "You always run into the ruins of something or other here." There are more than ruins in the path of the Cairo Metro. The surface geography is characterized by groundwater at very shallow depths and an uncertainty about how the ground will behave in response to excavation. Any settling caused by the tunnels would have serious consequences

for the heavily built over city above. A cooperative project between the University of Alberta in Canada and Ain Shams University in Cairo, funded by IDRC, will provide direct measurements of ground movements and stresses during construction to provide information needed to alter structural designs.

So while waiting for the subway, people here get by as best they can and put up patiently with the discomfort of dust and carbon monoxide. One interesting phenomenon is that Cairo probably has the highest concentration of university graduates or civil servants as drivers per taxi than any other country. Mohammed has a BA in Business from Cairo University. Abdul works at the Ministry of Housing. Omar has been an accountant in Persian Gulf banks at

lem is to live in government housing. The rent asked per month is one Egyptian pound (a little more than one Canadian dollar). On the other hand, you have to get used to lawns that double as garbage dumps, and to leaky pipes, erratic electricity, and open sewers.

Professor Madiha el Safty of the American University of Cairo comments that most moderately priced housing is built by the government; however, while the population of Cairo tripled to reach nine million, no more than an average of 30 000 housing units could be built per year. The main reason for this, says Prof el Safty, was the war against Israel, which monopolized national energy. After the Yom Kippur war in 1973, the whole Suez Canal Zone had to be rebuilt. All the resources of the construction industry were concentrated on that job. The situation did

begin to improve in 1981, but the rate of construction is still far behind the needs of the population.

The result is that what housing does exist is enormously in demand and prices keep on rising. Real estate speculation has played a part too; the few construction sites still available have reached impossible prices. At Heliopolis and Nasser City, which are the new "in" upper-middle-class suburbs, one can find modern apartments, only two or three years old, standing empty. Their owners refuse to sell them. They are simply waiting for prices to go up.

Dr Mongi explains: "It's the inevitable result if the stock is limited and demand very high." But what if those who put up buildings were forced to sell all housing as soon as construction was completed?" "Then builders would stop building." That expresses the whole of modern Egypt, born of *infitah*, the economic policy started up by the late President Sadat in a spirit of liberalism. Let the laws of the market operate, encourage private enterprise, limit government interference, and only intervene when it is needed for the restoration of equilibrium. But the State's incentives policies are not always very effective. For example, in an effort to relieve automobile traffic and avoid endless commuting travel, the government passed a law to facilitate housing exchanges between people living in the suburbs and working downtown and those living downtown and working in the suburbs. Nothing came of it and there is just as much traffic in both directions



Old Cairo (above), and the new Cairo (opposite): chaotic growth

a salary 20 times higher than people earn in Egypt, but since he returned to Cairo, he too has been driving a taxi so as to last out each month. For the rest of his time he works as a cook in one of the big hotels. Another problem, and a crucial one, is housing. Because of the tremendous pressure of population, Cairo is suffering from an appalling housing shortage. The hardest housing of all to find is housing at reasonable prices. "You can scarcely ever find an apartment for rent here," Dr Mongi of the National Planning Institute explains. "Generally speaking one has to buy in Cairo. Here, as anywhere else, the prices vary depending upon the size and district wanted, but everyone in Cairo will tell you that whatever the district and the amount of space one wants, all prices are similar in one thing — they are exorbitant. You can easily pay \$1000 (Canadian equivalent) per square metre for an apartment in Cairo," says Dr Mongi. "Calculate it for yourself, a 5-room apartment with an area of 100 square metres will cost you \$100 000. In a place where the average annual income is barely more than \$700 a situation like this is an absolute nightmare."

Lacking money, the other way of solving the housing prob-

as before.

In fact, one gets the impression that the government is, in a way, overwhelmed by the size of the task or, at least, caught short. A good example of this state of affairs is the construction of houses without permits in the city. It is estimated that about 80 percent of construction in the last five years has been done without authorization from the municipality. Construction is going on everywhere: on the roofs of buildings, in the avenues, in what used to be open green spaces, or even on farmland. This absence of permits casts a quite particular light on accidents such as the one in which a sizeable multi-storey building quite simply collapsed, killing a dozen or so of the tenants. Rumour had it that the builder tried to save money by speculating on the quality of the cement.

Another case which well illustrates the anarchic state of housing developments in Cairo is that of the City of the Dead. Hundreds of thousands of people have reportedly taken up residence in the necropolis city, which is nothing more nor less than a huge cemetery. Certainly, the use of the cemetery as a refuge for the living is a strange reversal

of things, and is even stranger when one learns that there is an elaborate network for leasing and subletting in the City of the Dead.

"What is even more serious" says Prof el Safty, "is that Cairo is in the process of becoming ruralized; the numerous inhabitants who arrive from the countryside bring rural habits and ways of thinking with them with the results that some districts of Cairo are little more than large urban villages." The countryside is transported to the city, intact.

Another phenomenon appeared towards the end of the 1970s — luxury apartments for the new economic elite. More than anything this is a symbol of the changes in Egyptian society brought about by the *infitah* economic policy. "The gap between rich and poor has increased considerably in the last few years," Dr el Safty explains. "The new economic policy led to the appearance of a new class of entrepreneurs, nouveaux riches, who copy their lifestyle from Western society." While the fortunate few who are members of this class have risen, most of the population of Cairo is grappling with a rising cost of living and housing which they either cannot afford or which is unhealthy, with endless traffic jams, and ever more extravagant patterns of consumption based on the developed country model.

Solutions do exist for the supply, transportation, and housing problems. There is talk of settling the desert to the East of Cairo so as to avoid encroachment on arable land. The government has built a complete city in the closer suburbs for graduates returning from university study abroad. This is an effort to stop the brain drain, and housing there is very cheap. In every direction the suburbs are growing rapidly. Private firms have shown an interest in collective transportation, which used to be a government preserve. Microbus taxis travel the streets of Cairo everyday and relieve the serious gaps in public bus service. But if a city overflows and so quickly transforms itself into a megalopolis, there is so much to be done. "What do you expect?" says Dr Mongi. "We have ideas but the problems increase faster than we can cope with them..." □

Guy Parent is a Montreal (Canada) writer who recently visited Egypt and Algeria as part of a journalist awareness program supported by the Canadian International Development Agency (CIDA).

SQUATTER MARKETS

Feeding a city that is growing at a rate of more than four percent a year is no easy task, and the challenge of keeping Cairo's nine million inhabitants supplied with fruits and vegetables has become more than the city's formal outlets can manage. In recent years, a large number of informal markets have sprung up to meet the demand. The squatter markets, as they are called, are located on land that is meant for other purposes — for example, areas under traffic overpasses are popular spots because they offer shelter from the sun and rain, and channel busy pedestrian traffic. The squatter merchant stakes a claim by setting up camp on the site, and proceeds to do business in a more or less uncontrolled manner.

Urban administrators have expressed concern at this, yet they are forced to acknowledge that the fruits and vegetables distributed through these vendors are providing a vital source of low-cost food for the urban poor. As they search for appropriate policies and legislative measures to deal with the problem, however, city officials have been hampered by lack of hard data on the markets, the merchants, and their share of the trade.

In an effort to fill this gap in knowledge, IDRC agreed to support a study proposed by the Urban Development Unit of the Social Research Centre of the American University in Cairo. The overall aim of the study is to describe and analyze the livelihood of urban squatter market vendors in Cairo in order to arrive at an understanding of their role in the food distribution system.

Five research sites selected to represent a range of neighbourhoods, both poor and affluent, and a variety of produce will be examined. The investigation comes along at a crucial period in the city's history, when a number of food-related issues are being reconsidered. Although fruit and vegetable production has increased immensely in recent years, it is not meeting the urban demand. There is dissatisfaction on both sides of the equation: Cairo newspapers carry stories of fruit sellers refusing to bring their produce into the city until prices rise; there are extreme shortages of common vegetables, like onions, and other produce (such as strawberries) is exported for foreign exchange.



Photo: Guy Parent

Squatter market under roadway: low-cost food comes to the urban poor



Not beautiful, but
well-used

A USEFUL SITE

URBAN PLANNING IN QUITO, ECUADOR

WILSON RUIZ

Until the mid 1950s, Quito was one of South America's smallest capital cities: less than 300 000 people. This changed dramatically as the massive rural migration patterns from rural areas in the Andes mountains to Quito produced a population increase of 200 percent over the last three decades. Today, more than one million people live in Ecuador's capital.

"Quito now faces massive housing problems. More than 40 percent of the population lives in slums or squatter settlements," explained Gilda Farrell, a professor of economics at the Catholic University in Quito. Profiteering and land speculation have pushed house prices beyond the means of most Quitenos. Even when the government constructs subsidized housing, rent costs often become so high that such housing is only affordable to the middle class or, at least, to those persons with steady incomes.

Many, perhaps the majority, of rural migrants moved to Quito in search of higher paying jobs between the sowing and harvest periods, leaving behind their wives and children to tend the fields in their absence. They often worked in the informal construction sector where pay is usually far below the designated minimum wage of 4000 *suces* — about 150 Canadian dollars — per month. Those lucky enough to find more permanent employment stayed in the city, inhabiting cramped and unsanitary dwellings in the older parts of the city, and bringing their families to join them.

To help Quito design appropriate housing solutions and evaluate the effectiveness of government efforts to provide low-cost housing, IDRC's urban policy program funded a recently completed study on the relationship between the urban land market and housing in low-income sectors of the Quito metropolitan area. The project, carried out by the *Banco Ecuatoriano de la Vivienda* — the Ecuadorian

Housing Bank — defined the role of state and private actors and suggested ways of improving availability of urban land for the poor.

The project, begun early in 1983, found that 60 percent of the total market demand for housing in Quito was for housing stock for investment and speculation. The year before, half of all land converted for housing in the city was held by speculators. Conventional housing solutions had largely failed because they were too expensive, tied to a market controlled by speculators.

"Our study showed that the best way to improve the availability of urban land for the poor is through a policy which would emphasize use-values rather than market-values," said Jorge Solomon, chief urban planner with the Ecuadorian Housing Bank. He also said that the viability of a particular land policy or system of policies is largely dependent on the degree to which such policies fit what is actually going on. "The problem with our present policy approaches is that they are not integrated with a complete process description or are geared to a process approach that is outdated or basically inadequate."

Besides the high cost of land, the study concluded, other reasons contribute to the housing crisis in Quito: among them, the high cost of construction materials, exigent technology and construction standards involving expensive procedures, and the lack of urban planning. In addition, poor people cannot qualify as "credit subjects" since they frequently lack permanent jobs and have no title to property.

The study recommended a series of decentralization schemes to reduce the housing problem in Quito. "While some success has been made in encouraging growth outside the city, more government-funded low-income housing projects should be built on

the outskirts." The study further suggested that the housing crisis can be efficiently solved by users themselves, provided they are given the necessary resources: land, finances, technical assistance and the freedom and security of tenure to build.

The major argument of the study is that without a full consideration of *situs* theory much urban land policy is shallow and inadequate. The urban principle of *situs* in essence states that each urban use needs and therefore seeds the location which will give it maximum accessibility to the other uses and services upon which it is dependent and a physical, social, institutional, and economic environment that is compatible and stimulating.

"In its broadest sense, the city is a highly integrated land use mechanism or macro-*situs* pattern," according to the study. The two most important ends of urban land policy are the establishment of conditions conducive to land use cooperation and controlled competition, and the maintenance of a dynamic equilibrium between cooperative and competitive states, the study suggested. Excesses of land policy that single out one use for favour or that tip the scale too far, either in the direction of cooperation or competition, would appear to contradict "natural" tendencies of urban structural interaction. "Without both elements, inefficiency and stagnation results."

As one of the study's urban planners put it: "I feel now, more than ever, that urban planning is — or at least should be — a social as well as an economic process. True planning should entail not just building nice neighbourhoods, but social change to solve the problems of distribution of wealth, services and opportunities." □

Wilson Ruiz is a Chilean-born freelance writer who recently visited the Quito project.



Alley cropping experiment (left), and farmer Yaya (right)

JEAN-MARC FLEURY

TREES TAKE TO THE FIELDS

At first sight, it would not be a surprise to learn from farmer Yaya that he had let his field turn into jungle. One can see a few heads of corn, but what is easiest to see by far are the bushes and grass covering this patch of land in southwest Nigeria.

Mr Yaya moves in with his cutter. The blade comes down, but, how odd, it spares the bushes. From closer up, one can see that the bushes are standing in continuous rows and that they are all of the same kind. Then, in a part of the field that has already been cleared, one realizes that the shrubbery was planted to form hedges, and that they break the land into alleys along which Mr Yaya grows maize.

Christine Okali and James Sumberg had warned us that the new alley cropping or row farming method might not be too much in evidence in farmers' fields. Back at the large research station operated by the International Institute of Tropical Agriculture (IITA) at Ibadan, Nigeria, where these two scientists run an IDRC-supported research program on small ruminants in cooperation with the International Livestock Centre for Africa (ILCA), the elegant geometry of alley cropping can be seen in all its simplicity: rows of shrubs spaced 3 or 4 metres apart form alleys or corridors in which several kinds of food crops grow — maize, yams, melons, rice, cowpeas, and others.

What is distinctive about alley cropping is that trees are treated like any other crop. For, even as they enter the fields, the proud lords of the forest lose their crowns. They are clipped up to

five times a year and the leaves and branches spread on the ground to serve as mulch and fertilizer. Some species of trees would quickly reach ten metres if they were not continually pruned, but, although the crown is constantly removed, the roots go on growing. They act as "nutrient pumps" to draw — from depths of five or six metres — the minerals that keep the upper layers of soil fertile. In many tropical soils the elements needed for plant growth sink too deep to be useful and ligneous plants ensure that they are continuously recycled.

It is not simply by chance that Biaun Tjwan Kang, "B.T." to his friends, the originator of alley farming, is a pedologist, or soil specialist. All too often he has measured what modern intensive farming takes out of African soils. Almost everywhere, not only does the soil lose its fertility, but wind and rain also carry away the most fertile top layers. Even adding fertilizers does not solve the problem. "Nitrogenized fertilizers acidify the soil," says Dr Kang. "They should be used as little as possible."

An answer of sorts has been around since agriculture began; all that is required is to burn a section of forest and plant in the ashes. After a few years, when the soil is exhausted, the operation is repeated a little further off.

Meanwhile, the brush covers the former fields. Shrubs grow into trees that once again are cleared and burned to become fertilizer for the benefit of the plants being cultivated. This migratory slash-and-burn agriculture, however, needs enormous spaces of unsettled land, something that population pressure now denies.

Nowadays the specialists recognize that intensive tropical agriculture, where food crops replace trees entirely, is not the answer either. For the last 15 or so years they have been trying to find out how to integrate trees with tropical agriculture. In 1981, IDRC supported a collaborative program of IITA and ILCA to determine the technical and economic feasibility and merits of alley cropping.

Alley farming, as developed at IITA by B.T. Kang, may turn out to be the way of marrying modern intensive farming and a healthy tropical environment. The alleys are formed by fast-growing trees, which are repeatedly cut back to prevent them from overshadowing the crops. At first, out of respect for large trees, they were polled — only the crown was removed. Now they are cut back to within a few centimetres of the soil. B.T. Kang's assistants have been cutting back *Leucaena leucocephala* five times a year for seven years. The trees always put out new shoots again.

Another tree that has adapted well to alley farming is *Gliricidia sepium*, which IITA and ILCA introduced from Central America.

The rows of *Leucaena* and *Gliricidia* provide a renewable and inexhaustible source of branches and foliage convenient to farmers. Used as mulch, leaves and branches prevent the growth of unwanted grass and replace herbicides. As they decompose, they contribute nitrogen, phosphorus, and potassium and reduce the requirements for fertilizers. They also help earthworms, which oxygenate and break down the soil, to multiply. On sloping land, the rows of bushes slow down the runoff of water and stop erosion. Farmers can also decide simply to let the trees grow: a longer thicker trunk for use as firewood or for construction becomes the crop.

Whatever the period between cuttings, an alley farmer must not hesitate to cut and cut again. Alley farming has created a biological machine that has to be closely managed. Dezi Mgambreki, an IITA economist who worked with B.T. Kang, notes that alley farmers have to work a little harder. It is the price that has to be paid for a biological system that supplies fertilizers, herbicides, and wood for heating and construction.

If the trees are left to mature, the resulting forest cover will finally clean out the grassy weeds by stopping the sunlight from reaching the ground. Yet at any time the farmer can cut back the trees and take up cropping again in the corridors. If a farmer wants to get out of alley farming altogether, there are herbicides that can easily rid the land of *Leucaena* and *Gliricidia*. The trees leave no bad residues, but simply enrich the soil by fixing atmospheric nitrogen, a characteristic of the legume family of which they are members.

The achievement of Christine Okali and James Sumberg at Ibadan has been to graft another biological machine onto alley farming and so come to the help of small farmers who are also, usually, small breeders. The other machine is small ruminants.

"Although agriculture in Nigeria's humid zone is dominated by food and tree crops, the 8 million small ruminants also found there represent a major underexploited resource," the ILCA team noted. "In the southwest, sheep and goats are present in many rural households, but are not integrated into the farming system. The average flock size is 2-4 animals per owner, with goats more common than sheep. Besides their other uses, small ruminants play an important role as an investment that can easily be converted into cash when needed. They represent one of several minor farm enterprises that lend a measure of diversity and thus stability to the total farm economy."

The raising of small livestock was limited, however, by lack of suitably cheap and nourishing feed. The ILCA

team tried *Gliricidia* and *Leucaena* — with very encouraging results. Sheep and goats whose diet is supplemented with a mix of *Gliricidia* and *Leucaena* have better appetites. Lambs and kids are born stronger, survive better, and grow more quickly. During the long dry season the trees provide the only green forage and play a vital role in the survival of flocks and herds.

The two ILCA scientists have set up "intensive feeding gardens." In 200-square-metre areas the two shrubs are grown along with *Panicum maximum* and *Pennisetum purpureum* grasses. Each pasture, with three rows of forage

A TALE OF TWO TREES

Alley farming — growing crops between rows of frequently pruned leguminous trees — offers a promising alternative to the traditional bush fallow system for maintenance of soil fertility in the humid and sub-humid tropics. Work at the International Institute of Tropical Agriculture (IITA), Ibadan, Nigeria, has demonstrated that alley cropping can maintain crop yields at moderate levels without fertilizer. In addition, the prunings can be used as feed for small ruminants, particularly in the dry season, when their reproduction and growth may be limited by protein deficiency. There are 26 million sheep and goats in West Africa; they make an important contribution to the diet of the region's inhabitants, many of whom suffer from malnutrition. In 1981, a nursery of 20 species from the Forest Research Institute in Nigeria was established. Treatments designed to exploit the different strengths of each species were developed, but to date no species has shown the vigour or desirable growth habit of either *Leucaena* and *Gliricidia*. As a result it has been decided to concentrate on *Leucaena* and *Gliricidia*, and a small evaluation trial of 46 locally collected lines of *Gliricidia sepium* has been started. Maize yields were 2.2 t/ha in the continuous maize plots, 2.5 t/ha in the continuous alley cropped plots and 2.6 t/ha in plots in which maize is rotated with grazing in between the *Leucaena* rows. The *Leucaena* contributed a total of 155 and 178 kg N/ha in the two alley cropped treatments respectively. A nitrogen response trial, also established in 1983, will provide a base from which to estimate the fertilizer replacement value of the *Leucaena* prunings.

bushes and six rows of grasses, can suffice to feed four or five sheep or goats, which would otherwise subsist on a meagre diet of scraps. The animals do not set a hoof inside the pasture; the upper foliage and grasses are "cut and carried."

At the moment, IITA and ILCA specialists are evaluating the acceptance of alley farming by farmers and its effect on crop production. Those questioned by Dezi Ngambeki say that they do work harder, but they are pleased at having lowered their costs for fertilizers and herbicides. In the savanna, where trees are scarce, it is particularly the production of wood for heating and construction that is appreciated. In the more humid regions, farmers have found a new ally in the struggle against unwanted plants, one which also helps to maintain the fertility of the soil.

Alley farming can be adapted to a wide range of priorities. As it is a synthesis of agriculture, forestry, and animal husbandry, farmers can put the emphasis on whichever type of production they need the most. If a farmer wants wood, he can let the bushes grow: some plots have produced up to 13 000 standards per hectare. If forage from the tops is more important, repeated pruning will give a farmer from 15 to 20 tonnes a year, the equivalent of 5 to 6 tonnes of dry material. If the alley farmer decides next to plant corn, there will be an excellent yield without any other input than the leaves and branches from the bushes. Whatever the priority, at the cost of a measure of compromise, the farmer can have wood, vegetables, and forage — all at the same time. All of this is available with the satisfaction of knowing that it is not done at the cost of any deterioration of the land.

Specialists in tropical agronomy have insisted upon the need to integrate trees into agriculture, and now the work of Kang, Okali, Sumberg and their colleagues seems at last to have demonstrated the potential of integrated production. Agroforestry, previously only a concept, is now moving towards reality, thanks to alley farming. It should be no surprise then, if a country like Kenya decides to re-think its agricultural development around the central concept of agroforestry. Perhaps scientists have at last succeeded in rediscovering a kind of agriculture that respects the tropical environment, does not ruin farmers, does not acidify and exhaust the soil, and protects the soil from being carried off by the wind or the rain.

The idea is moving into the field. Teams are already trying to adapt this model to various environments worldwide. ILCA has begun to distribute posters that start out: "Plant a row of shrubs every four rows of corn..." □

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CONTROLLING THE CHEMICAL THREAT

JAMES MPINGO

Photos AP Wirephoto/Canapress



Bhopal: child blinded by the gas leak from pesticide plant (background). An international program for protection against chemical hazards — not just disasters — must be strengthened.

The recent tragedy in India — over 2000 dead and many others permanently handicapped by the release of toxic gas from a pesticide plant in Bhopal — has made the world painfully aware of the potential hazards posed by chemicals.

The simple animal, vegetable, and mineral substances that once composed the harmony of earth have been joined by substances that had not existed until they were created by human scientific and industrial effort. These are the synthetic chemicals that span every sphere of our lives from food production, construction materials, clothing and packaging down to the ubiquitous plastic toys.

Despite all the good and useful wonders of science that we take for granted, the chemical world has brought real and potential perils. Some of the chemicals are so toxic that they threaten the very basis on which life depends. These perils were first brought to our attention by tragic incidents:

- The outbreak, in 1959, of "Minimata disease" in Japan was traced to industrial discharge of mercury compounds into waterways. Over 1000 people who had eaten fish from the contaminated waterways became ill and more than 50 died.
- The dreadful deformation of children whose mothers had used the tranquilizer thalidomide during pregnancy was a high price to pay for the increased awareness of dangerous pharmaceuticals.
- The cost of careless waste disposal was exemplified by the contamination of rice oil with PCBs. Over 1000 people became ill as a result of long-term exposure to low-level toxins.
- Premature sexual development of 3000 youngsters on the island of Puerto Rico is suspected to be the result of misuse of growth hormones in the poultry industry.

The devastation at Bhopal outweighs any previous chemical accident.

Although the toll of victims from large-scale accidents is tragic, the overall number of individuals affected by toxins in their daily lives is even greater. The individual cases of acute intoxication are difficult to estimate or prevent. Exposure to certain kinds of chemicals has delayed effects such as cancer, reproductive and nervous disorders and cardiovascular diseases which are even harder to assess.

Pesticides alone are estimated to poison as many as 500 000 people, actually killing an estimated 10 000 people in developing countries every year.

As part of the attempt to grapple with the problems of exposure to dangerous chemicals, the UN initiated the International Programme on Chemical Safety (IPCS) in 1980. The UN Environmental Programme (UNEP), International Labour Office (ILO), World Health Organization (WHO) and participating institutions of member states (such as Health and Welfare, Canada) contribute funds and cooperate to carry out the programme objectives.

IPCS coordinates the research into food, workplace and environmental contaminants performed by various UN agencies. It also evaluates toxicity of compounds and helps establish or adapt guidelines for risk management.

Last fall a meeting attended by 15 nations was held in Nairobi to consider the relevance of IPCS to developing countries. Chemical hazards which used to be considered only in the context of industrialized countries are increasingly a worry for the less developed nations.

WHO suggests that chemical exposure risks are even greater in these countries than in the developed ones due to a number of factors. These include:

- International trade in hazardous or inadequately tested products, especially when the sale of such substances has been banned or restricted in their countries of origin;

- Lack of awareness on the part of decision-makers of the environmental ill-effects of the chemicals they buy, and a consequent lack of corresponding laws and regulations; and
- Intentional or unintentional disregard of the problems caused by local industries.

Of the three, the international trade in hazardous and inadequately tested chemicals is the most ominous problem. Industrialization of agriculture coupled with high-pressure salesmanship by multinational corporations has resulted in imports of thousands of tonnes of chemicals by the Third World.

The situation is further compounded by what many in the Third World see as a double-standards approach to the whole issue of chemical safety. Chemicals that could not stand up to the rigorous tests of safety demanded by health-conscious consumers in most of Western Europe and the United States are exported to less developed countries.

Although many Western governments have adopted stringent regulations on the sale of certain chemicals within their own countries, they still allow the manufacture of the same products for export only. Many of the 60 000 chemicals in common use today go to such places as Mexico's cotton-growing region of Tapachula. Crop-dusting planes spray cotton

fields there with a fine mist of the pesticide Galecron. A slight breeze spreads the chemical over the nearby *campestinos*, animals and unprotected food in the shacks on the outskirts of the fields.

In the areas where the pesticide is mixed and loaded into dispensers, children work and play. Galecron's active ingredients, chlordimeform (CDF), is a suspected carcinogen. Recent reports say that farm workers in Mexico, Bolivia, Colombia, Honduras, Nicaragua, El Salvador and Guatemala accumulate CDF levels of up to 50 times what is considered safe by WHO. Half a world away in Europe, Galecron is banned.

The Latin American story repeats itself all over the developing world, with different chemicals and different victims each time. Lech Piekarski, UNEP's program officer for environmental health, warns that nobody is immune from the "chemicalization of man" these days.

The developing world, he says, is rapidly catching up with the developed North in its use of chemicals and, without proper controls or sufficient understanding of their use, the problem surrounding their abuse and misuse becomes even greater.

Indeed, some of the problems associated with increased and widespread use of chemicals, particularly agrochemicals, are already sending warning signals that some of the manipulations from the world's research laboratories could well be doing more harm than good. In the long run, therefore, IPCS is banking on sustainable agricultural practices and manpower development as the best means of preventing acute and chronic poisoning and environmental damage by pesticides.

Just how can organizations such as IPCS stand up to the challenges manifest in the increased use of chemicals in the Third World? For here, more than elsewhere in the world, the introduction of toxic chemicals has evoked the old and well-understood spectre of poisons.

As the number of chemical accidents and cases of acute chemical intoxication increase in both developed and developing countries, so will the need for international cooperation. Chemical safety can only be sustained with sound, objective and thorough evaluations of the health hazards of chemicals. These tests are extremely expensive. It is estimated, for example, that the cost of assessing one chemical substance could be as high as US\$1 million — a figure too high even for rich economies of the world, given the large numbers of chemicals that come into use every year. The resources of the world must be pooled to save it from widespread disaster.

IPCS is encouraging Third World policymakers to establish interdisciplinary national committees on pesticides to act as advisory bodies to health, agriculture, labour and envi-

ronment ministries. This is particularly crucial at a time when the catchword in most of the Third World should be "handle with care."

To date, some Third World countries are estimated to have registered more than 1000 compounds as pesticides, formulated in thousands of commercial products. A WHO report on "the dangers and precautions" of pesticides tabled before the Nairobi session says that trade in pesticides was fast becoming a multi-billion dollar business. Pesticides imported by developing countries today account for over a billion dollars (\$US) annually, up from US\$641 million only a decade ago. In 1978, Third World pesticides sales represented 39 percent of the international pesticides trade volume.

Developing countries are themselves producing some of the most toxic and hazardous pesticides for local consumption. Local production of pesticides, unless closely monitored and controlled, could entail additional risks to public health because the production process may differ from the original. WHO warns, "This

can give rise to other toxic compounds which may remain as impurities at dangerous levels."

Perhaps the most difficult question before expert groups such as the IPCS is one of criteria for intervention. With 60 000 or so chemicals on the market today, which substances should be singled out as priority targets by IPCS for evaluation of their potential risk to human health and the environment? And by which methods should potential risks be assessed to make the evaluations internationally acceptable? These, and other related issues, pressed home before those meeting in Nairobi the complexity that comes with the diversity of chemicals and the differences in national approaches to chemical safety.

According to Dr J.W. Huismans, UNEP's man to the IPCS team, the program's spotlight is increasingly going to narrow down onto the Third World in the next decade or so. The selection criteria for chemicals up for evaluation is swinging due South. Huismans said, "We are going to focus on chemical substances that are of major concern

to the developing world. We are also going to tone down the scientific jargon in our evaluation." Simplified risk-assessment manuals, training courses for Third World managers and increased participation of developing countries in the program is a package deal which will be promoted by IPCS.

This service, when finally carried out, will be crucial because most Third World chemists only have sales leaflets from manufacturers to guide them. These tend to be designed for sales promotion rather than the promotion of safety. These manuals and courses are welcome initiatives, because it makes little sense for IPCS to parade their impressive scientific publications of the past four years if users cannot take a single leaf out of them for application on the ground.

Dr Michel Mercier, IPCS Manager, says that the capacity of most countries, especially developing ones, to control and regulate the safe use of chemicals and to adapt to the country the results of risk evaluation made elsewhere, has largely been limited by shortage of appropriate experts. "IPCS has therefore given high priority to manpower development in developing countries and is promoting the training of toxicologists and other experts needed for chemical and environmental health hazards assessment and control," he says.

IPCS documents are prepared with the participation of a network of 47 scientific institutions. WHO's Inter-Agency Research group on Cancer (IARC) and UNEP's International Register on Potentially Toxic Chemicals (IRPTC) are among the participants.

While the safety of chemicals has been predominantly a problem of the industrialized world, Third World trade involvement in a multi-billion dollar chemical business and the recent disaster at Bhopal has jolted many of our policymakers into soul searching. Developing countries, already confronted with the overwhelming task of controlling many diseases and other long-term priority health problems for ever-increasing population, may not find it expedient to grapple with the new dangers posed by chemicals.

There is, however, a growing recognition that if development is to be sustainable, the problem of chemicals can no longer be ignored in national health policy, and that, postponement of preventive action may well turn out to be a costly omission. □

James Mpinga, a freelance writer on development and environment based in Nairobi, was until recently editor of Ecoforum, the newsletter of the Environment Liaison Centre of the United Nations Environmental Programme.

KNOWING THE THREAT

As agriculture and industry in developing countries come to rely increasingly on synthetic chemicals and mechanization, so the incidences of industrial accidents and deaths increase. Workers in the fields risk poisoning by the pesticides, herbicides, and fertilizers they are exposed to; and workers in the factories risk illness and injury from the dusts, chemicals, and machinery with which they come in contact.

The actual extent of occupational health hazards, their causes and the solutions cannot be determined without adequate research. IDRC has supported a number of studies in Asia, Africa, and Central America which are trying to establish accurate figures for the incidents of occupational hazards in agriculture and industry.

The use of pesticides is widespread in Southeast Asia, and although estimates indicate significant numbers of pesticides poisoning, few concrete data exist. The Asian Association of Occupational Health (AAOH) has undertaken studies in Thailand, Indonesia, Malaysia, and Sri Lanka to determine the magnitude of pesticide poisonings in these countries, its causes, and the improvements

needed concerning appropriate legislation.

This is the third in a series of projects proposed to IDRC by AAOH. The first was an inventory of occupational health problems in South-east Asia, and the second was an investigation of the health hazards of small-scale industries in the area.

The long, exhausting hours worked by fieldhands in the banana plantations of Honduras and the workers' undernourishment make them prone to accidents and illnesses on the job. As their work becomes more mechanized and the use of pesticides and herbicides becomes more common, the risk of health problems becomes greater.

With funding from IDRC, a research team from the Universidad Nacional Autonoma de Honduras is examining the records of the United Fruit Company from the period 1976-1980, to determine the number of work-related accidents and deaths.

The goal of all the projects described is to provide planners with the necessary background information to establish safety regulations, legislation and training to deal with the issue.

MYCOTOXINS AND MALNUTRITION

HOPE CADIEUX-LEDoux



Kwashiorkor in three-year olds: a link to mouldy grain?

They called it St Anthony's Fire in the Middle Ages — a disease caused by eating mould-infested grain. It brought on vomiting, burning, and cramping of the abdomen, loss of feeling in the extremities, and, occasionally, convulsions. A survivor might develop gangrene or cataracts. It killed thousands during the Middle Ages. Outbreaks still occur from time to time in various parts of the world.

We now know that St Anthony's Fire, or ergotism, is caused by a poisonous compound — a mycotoxin — produced by the fungi *Claviceps purpurea*. We also know that it is not the only mycotoxin capable of wreaking havoc with the human organism.

Another of these lethal mycotoxins is aflatoxin, found in the common mould *Aspergillus flavus*. A powerful carcinogen, aflatoxin has been implicated in a number of diseases in animals and humans, and recently linked to the childhood disease, kwashiorkor.

Kwashiorkor, a word from the Ga language in Ghana, literally means "the disease of the first child when replaced at its mother's breast by a second." Characterized by swelling, skin lesions, hair changes, failure to gain weight, general listlessness, and a reddish-orange tinge to the hair, kwashiorkor has been thought to be caused by a protein-deficient diet. The disease is all too common in developing, tropical countries.

A number of clues have now prompted scientists to suspect a link between kwashiorkor and aflatoxins. First, the metabolic effects of aflatoxin on animals and kwashiorkor in children are similar: abnormally low levels of albumin (protein) in the blood, fatty degeneration of the liver, and depressed ability to fight off infection.

Second, the warmth and high humidity of tropical climates provide ideal conditions for the growth of many moulds. Thus, foods in developing countries are often contaminated, either constantly or seasonally, by mycotoxins.

And, finally, the geographical distribution and seasonal fluctuation of mycotoxin contamination of food is remarkably similar to that of kwashiorkor, which tends to peak in the wet season in many areas.

In 1981, with the financial assistance of IDRC, researchers in Sudan at the University Teaching Hospital, Khartoum, and the Liverpool School of Tropical Medicine (U.K.) undertook a 3-year investigation to attempt to correlate ingestion of mycotoxins and seasonal variations in their level with actual cases of childhood malnutrition.

The focus of the investigation was a group of children who had been admitted to the Khartoum teaching hospital with kwashiorkor. They were studied in parallel with children with marasmus (a muscle-wasting syn-

drome associated with gross calorie deficiency) and marasmic-kwashiorkor children of the same age and sex. As an additional comparison, a control group of well-nourished children in the same age range was also studied.

The food study consisted of examining common foods from the local markets and samples of food prepared in the children's homes ("food on the plate") for mycotoxins. Aflatoxins have so far been detected in groundnuts, chickpeas, dried ochra, and peanut butter — all obtained from local markets.

The investigation so far indicates that children in Sudan are exposed to aflatoxins in their diets and that these substances can be detected in the blood and urine of a high proportion of the young child population. The fact that aflatoxins were detected more often and in greater amounts in the blood of the children with kwashiorkor than in normal controls suggests either the kwashiorkor group consumed larger quantities of aflatoxins in their food or they were less capable of eliminating the poison than their normal or marasmic counterparts. "Food on the plate" studies are now underway to determine whether the diet of children with kwashiorkor is actually higher in aflatoxins than the diet of the children in the other groups.

For the moment, the researchers conclude that children with kwashiorkor are at greater risk from aflatoxin than are normal children. Moreover, the detection of aflatoxicol (a product of the aflatoxin metabolism) in the blood of children with kwashiorkor or marasmic kwashiorkor — but not in marasmic children or controls — indicates some fundamental difference in the way aflatoxins are handled by the two categories of children. Whether this difference is a cause or consequence of kwashiorkor remains to be seen.

If aflatoxin does cause kwashiorkor, the implications for the management of the disease are considerable. For one thing, the large doses of protein usually administered as a cure might be altered in favour of a treatment less taxing on the liver. On the other hand, public health measures could be taken to prevent kwashiorkor by reducing the level of fungal contamination in food through better food handling and storage methods. Given the extent of protein-calorie malnutrition in the Third World — UNICEF estimates in 1982 more than 40 000 children died per day as a result of malnutrition and infection — any knowledge that could shed light on the causes or control of kwashiorkor will be welcome indeed. □

Hope Cadieux-Ledoux is a Canadian freelance journalist specializing in development topics.

The OXFAM energy biscuit: a new approach in relief foods

Food energy, as well as protein, is vital when treating acute malnutrition. A new, high-energy (calorie) biscuit developed by OXFAM-UK, the international relief and development agency, addresses this need. The 25-gram biscuit provides 125 kcals (dietary calories) and 8-9 percent protein for use in nourishing starving children in disaster situations.

The biscuit compares favourably with other sources of calories and protein: for instance, a slice of bread contains 65-80 kcal and an egg, which is generally considered a good source of protein, contains about 12 percent protein. The small, energy-rich biscuit enables relief agencies to feed severely malnourished people in the early chaotic stages of a disaster when local foodstuffs or the water, firewood, and cooking utensils needed to prepare traditional relief

foods are not available.

In 1982 OXFAM approached Oxford Polytechnic (U.K.) to investigate the relief foods available and to develop a recipe for a high-energy biscuit. "We wanted a stable product which was easy to store and to distribute, and a simple recipe which was easy to produce locally," an OXFAM spokesperson said.

The investigating team, a food scientist and an anthropologist, discovered that although there were plenty of "high-protein" biscuits — such as one used by the armed forces — available, none met OXFAM's criteria. A simple recipe for a biscuit containing 500 cals per 100 g was developed. The ingredients are wheat flour, vegetable oils, dried skimmed milk, sugar, and salt.

The slightly sweet, crumbly biscuit has appearance and taste similar to shortbread. Field tests in India and Somalia indicate that it is more acceptable to children, surprisingly, than other,

sweeter, biscuits. Children derive the calories they need from the oil portion of the biscuit. Butterfat was used in the original formulation of the biscuit, but it has since been replaced by vegetable oil to increase the shelf life to 18 months and to improve acceptability.

A British company, Foxes, produces the biscuit. A trial run of the biscuit was undertaken by a biscuit factory in Kampala, Uganda, and there are plans to produce it in Addis Abbaba, Ethiopia.

The OXFAM energy biscuit was well received when five tonnes were distributed to feeding centres in Wollo province in Northern Ethiopia and in the Wolayta area in the south. An additional 50 tonnes has been shipped to Ethiopia.

The biscuit was designed to supplement the general ration of children and other vulnerable groups such as the sick, elderly, and pregnant or lactating women, since their energy needs are highest. It can also be used as a short-term rehabilitative ration to provide complete nutrition up to 2000 kcals in 4-5 feeds. Since each 25-gram biscuit contains 125 kcals, relief workers can easily count a child's intake of calories. If a child has eaten only three biscuits, he or she is 125 kcals short of a bare maintenance daily need of 500 kcals.

"Nutritionists believe calories are as important as protein in starvation situations because if calorie intake is inadequate, metabolism begins to convert body protein and use it up," said a spokesperson for OXFAM.

The OXFAM biscuit appears to be one low-

cost, easily distributed option now available to relief agencies to provide a high-energy emergency foodstuff.

For information: OXFAM Health Unit, 274 Banbury Road, Oxford OX2 7D2 U.K., tel: (0865) 5677, Telex 83610.

Journalism bridges the gap

News coverage of the building of a bridge in September, 1979, set in motion a wave of local initiative, cooperation, and appropriate technology in southern India.

Students of the Regional Engineering College in Surathkal, a coastal town in Karnataka, as part of their activities with the National Cadet Corps, built a suspension bridge across a river in a nearby village. *Udayavani*, a popular daily newspaper in Kannada, the local language, and with a circulation of 75 000, carried the news story of the building of the 165-foot bridge at a cost of Rs 65 000 (about CA\$9000).

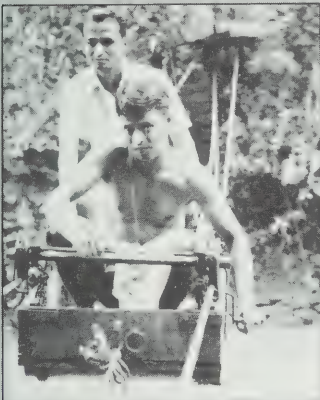
The coverage of the engineering college students' success in solving a perennial problem for the villagers by building a low-cost suspension bridge of steel cables and wooden planks attracted the attention of the newspaper's readers.

Udayavani daily, which has the third largest daily circulation in Karnataka State (population 37 million), one of the four south Indian States, mainly caters to readers in the two coastal districts of the area and the four districts in the Western Ghats region of the State. Thousands of villages in this area are cut off by the many rivers and streams that are in spate six months of the year



OXFAM biscuit for emergency nutrition

because of heavy rainfall, which averages about 300 cm (120 inches) a year. Building bridges across all these water courses is definitely beyond the resources of the government, and so the locals solve their problem temporarily every year by



People's bridge, Karnataka

using country boats and canoes or building risky wooden footbridges at their own cost.

The first news story of the bridge carried in the fall of 1979, with a picture of the span, prompted a chain reaction among the villagers — who learned that a more permanent solution to their transportation difficulties was possible.

Soon stories were coming in regularly about other bridges being built in villages far from the cities: An agriculturist with little secondary education built a rope bridge with the help of the local people; an engineer who had settled in his ancestral farm designed a rope-trolley to cross a river; and a group of local youngsters used a canoe to attach a cable across another stream. The spirit was spreading. *Udayavani*, a newspaper committed to the development of the area, did not let the feats go unnoticed. The story of each bridge was published, sometimes the front page, sometimes on the feature page, often with good pictures and briefs about their costs. When the occasional failure took place — a span was not completed or was substandard — that too, was reported.

It is almost six years since the paper carried the story about the first bridge, and at least 20 similar bridges have been built in the region since then. *Udayavani's* development reporter keeps getting letters from unknown villagers inviting him to visit their area, see their new bridge, and report about it. No request is turned down. Inspired by this experience, *Udayavani's* managing editor announced a new scheme of helping rural people construct suspension bridges. In this connection, a survey in the spring of 1984 was carried out with the help of the readers to identify suitable sites for rope bridges. Over 200 places have been suggested. Details are now being worked out to construct bridges for as many crossings as possible, making the best use of voluntary agencies, government assistance and the local enthusiasm for the project, all of which can be traced back to that first news story.

Ishawara Bhat, senior reporter, Udayavani

Exploding some myths about the rural exodus

The migration of rural peoples to the cities is taking place at an unprecedented rate around the world. Little is known about whether it is possible or desirable to

stem the flow, and past attempts have had little effect because planners lacked knowledge of the causes and consequences of this phenomenon.

Recent research by the International Labour Office (ILO) has led to questioning of some of the conventional myths about migration. One is that the glamour of city living lures people to the city. In fact, the poverty of rural areas drives people into the urban centres — they are not lured.

The massive migrations raise fears of urban unemployment, overcrowding, and shortages of public amenities. The rural areas are also seen as suffering, losing their more dynamic members and the potential investment to life in the towns. The findings of ILO demographers A.S. Oberfai and K.M. Singh show that moving to the city may, however, yield substantial benefits to individual migrants and their families and, at the same time, have a positive effect on development of the rural areas.

Analysis of urban data suggests that migrants not only swell the labour force, they also stimulate industrial expansion and other economic activities. Their waiting period for employment seems to be about two months, and they attain equal economic status with urban natives in a sur-

prisingly short period of time. There is no evidence that they are confined to marginal employment in the cities, or that they contribute disproportionately to urban unemployment.

In the countryside, the exodus may lead to a reduction of population and a new environment conducive to changing rural production techniques. There may be a rising demand from the cities for rural output that stimulates agriculture and rural industrialization, thus helping to raise villagers' incomes. Similarly, remittances sent home by migrants may improve the distribution of income between the rural and urban populations, especially when the money is used for investment purposes.

The ILO research suggests that migration cannot, or even should not, be completely controlled, since it is a part of the whole process of economic growth and social advancement. Nonetheless, as the rural-urban drift continues to grow, steps must be taken to mitigate its adverse impact on both the village and the city. Action is needed to prevent the disparities in employment opportunities; the loss of skilled labour in the countryside, and the problems of slums, squatters, and deterioration of services in the cities. This can only be achieved within the framework of a national migration policy that recognizes this movement as an integral part of the nation's development and tries to harmonize it with increased industrialization, agricultural output, and social benefits. (ILO Information)

Tobacco farming in the Third World

While tobacco consumption is decreasing by 1.1 percent yearly in industrialized countries, it continues to increase by twice that rate — 2.1 percent a year — in the Third World. These statistics have led the World Health Organization (WHO) to warn that the occurrence



The myth of the city: pushed, not pulled

of cigarette-induced diseases, such as lung cancer, bronchitis, and coronary thrombosis, is taking on alarming proportions in the developing countries.

Developing countries now produce 63 percent of the world's tobacco. Given that the foreign exchange earnings generated by tobacco will probably encourage further expansion, developing countries are now facing a conflict between the health costs and the economic returns of growing this non-food crop. (See *Reports* 12(2) July 1983, "Up in Smoke" for an examination of the "smoking epidemic.")

The effects of increased smoking in the Third World appear in mortality statistics: there are an estimated 590 000 new cases of lung cancer every year, and over a million premature deaths related to cigarette smoking. A growing number of cases occur in developing countries, where lung cancer risks for smokers have been shown to be as much as nine times greater than for non-smokers.

Tobacco can be especially harmful to women. Studies have shown — at least in developed countries — that women who take oral contraceptives and smoke cigarettes run almost four times the normal risk of death by cardio-vascular diseases. Chewing tobacco in Asia also has been linked to a four times higher rate of stillbirths.

But a study by the U.K.-based Economist Intelligence Unit (EIU), a subsidiary of the respected *Economist* magazine, suggests that there are a number of benefits accru-

ing to the Third World as a result of tobacco production. Besides its importance as an export commodity and in satisfying local demand and saving import costs, tobacco cultivation apparently uses only 0.37 percent of the total arable land in developing countries. In addition, it encourages a breakaway from subsistence farming and, as a labour-intensive crop, it helps use surplus labour.

Evidence gathered by the EIU also suggests that the practices used in the cultivation of tobacco have a spillover effect that may enhance the growth of other crops. Because tobacco only occupies the land for part of the year, the fertilizer applied to the land for tobacco benefits a second crop, as with sugarcane in Jamaica.

Although neither the EIU study nor WHO weighs the loss of life and working days associated with tobacco smoking against benefits of tobacco cultivation, many countries in the Third World are going to have to judge and make difficult development decisions on tobacco.

The lifting of the Nestlé boycott

The international boycott of Nestlé products was formally ended October 4th last year. The marketing practices of the Swiss-based multinational corporation in promoting its infant formula in the Third World had led to a worldwide boycott begun seven years ago.

Organizers of the International Nestlé Boycott Committee (INBC), an amalgam of international consumer and development action groups, announced that they were

satisfied that the company was complying with the requirements of an international marketing code for breast milk substitutes drafted by the World Health Organization (WHO).

The appropriateness of the message and techniques of Nestlé's sales approach in developing countries had been the subject of severe criticism. Boycott organizers were upset that the company promoted infant formula as better than breast milk, and that its safe use required sanitary practices beyond the capabilities of impoverished families.

Mothers in developing countries were very susceptible to the sophisticated marketing approach used by Nestlé and others, said Mrs Pat Young, spokesperson for the United States Boycott Committee.

Many women in the Third World are illiterate and unable to read the directions concerning proper usage on the labels. Poor sanitation and tainted water used in making formula turned nourishment into deadly disease transmission. Some mothers, too poor to afford adequate quantities of formula to sustain their babies, diluted it to the point where the infants slowly starved to death.

The international code of marketing Nestlé signed early last year addressed these problems and several others related to the approaches the multinational used to market its product. New labels and accompanying literature for the mothers were redone by an independent panel of experts to include appropriate graphic instructions for an illiterate user. Ade-

quate warnings about health precautions such as sterilizing bottles and boiling water were added, said Mrs Young.

Dr Chad Jackson, the vice president for Nestlé's coordinating centre for nutrition in Washington, said that the company has supported the principles and aims of the code since 1981, but did not know exactly how to implement them.

While boycott organizers are satisfied that the company is making serious efforts to follow the guidelines, and, as a consequence, have lifted the boycott, they will still be monitoring the company's practices in the field. The boycott committee intends to continue pressuring other companies. Mrs Young said that because Nestlé, which has half the market, has complied with the code on marketing infant formula, the others should be influenced by this action.

Although the boycott has succeeded in its goals and has demonstrated that health workers, advocacy groups, governments, and corporations can work together to achieve something beneficial for everyone, Mrs Young pointed out that, "The true victors are the babies and their families, not the advocacy groups, the company, or any of us."

Dr Jackson agreed, but he was less optimistic about the impact. "I hope that all of this ultimately benefits the mother in the Third World. There are so many other factors that cause infant mortality, however, that I don't really expect a measurable drop as a result of Nestlé's following the code."

Andrew Williams

NEW RELEASES

IDRC 235e



SEARCHING

IDRC 1984 — The Rural Experience

Searching: IDRC 1984 - the rural experience

The IDRC annual review, published January 1985, IDRC-235e, 40 pages.

The focus of this year's *Searching*, the annual review of IDRC, is the problems facing the rural poor of developing countries. Since IDRC's inception 14 years ago, the majority of its funds has supported research in science and technology that would benefit dwellers in the countryside and villages of the Third World. The 1984 *Searching* describes a sampling of the many IDRC-supported projects in agriculture, health sciences, social sciences, and communications.

In introducing this year's *Searching*, IDRC President Ivan Head sets the theme for the description of the centre's projects in examining how the politics of rural neglect affects the quality of life in rural villages.

"Particularly today in the developing countries, village life is often nasty, brutish, and short," writes Mr Head. "Increasingly as well, it is culturally arid. Governments, hard pressed to provide the basics of modern life to the inhabitants of cities, find that available resources seldom permit the extension into the countryside of adequate social services such as health care and educational facilities. Fresh, clean water, adequate shelter, waste

disposal, food distribution, cooking fuel — these essential ingredients of even a tolerable life — are all too often missing in the villages of many Third World countries."

The projects included in *Searching* represent some of the attempts to eliminate malnutrition, disease, deforestation, infant mortality, and illiteracy in the rural areas of the Third World by funding the work of researchers operating outside of the cities.

This document also includes a brief description of the nature of IDRC, the scope of its programs, and the publications and films available on its research projects. (Also published in French and Spanish).

La toxicité du manioc et la thyroïde: recherches et questions de santé publique. F. Delange, R. Ahluwalia, editors. Published February 1985, IDRC-207f

This publication is a French translation of IDRC-207e *Cassava toxicity and thyroid: research and public health issues*, the report of a meeting of agricultural, medical, and public health researchers on the relationship between the consumption of cassava and the existence of thyroid conditions in humans. After reviewing IDRC-supported studies on the links between cassava and goitres and cretinism, research on cassava cultivation, and related studies, the researchers identified areas for further research and made recommendations for public health programs to control goitres in developing countries.

Vivienda basica: Politicas solve lotes urbanos, servicios y vivienda en los paises en desarrollo. Aprodicio A. Laquian. Published April 1985, IDRC-208s.

After thirty years of

trying to eradicate slum areas, most governments in developing countries have adopted a more conciliatory attitude and have shown a remarkable creativity in attempts to improve housing for the urban poor. This monograph, a Spanish translation from IDRC-208e *Basic housing: policies for urban sites, services, and shelter in developing countries*, discusses the results of research on the planning and execution of housing programs in the Philippines, El Salvador, Senegal and Zambia, and other countries. It is addressed primarily to decision-makers and administrators who will implement these types of programs. Examined are questions on family revenue, employment, health, organization, education and community participation.

Footholds: research for South America's rural poor

A 29-minute color film, produced by IDRC's Communications and Social Sciences Divisions. English, French, and Spanish copies available as 16 mm prints or U-matic, VHS, or Betamax video cassettes. Released January, 1985.

Indians, mestizos, and the descendants of African slaves — these are the peasant farmers of Latin America, the *campesinos*. With only small plots of land, a few simple farm tools, and little access to credit, they are South America's rural poor.

The *campesinos* not only do not benefit from modernization, but they also are its victims in some ways. Their tiny, multicrop farms cannot




compete with the expansive, highly-mechanized *haciendas* of agribusiness. They are often forced to sell their farms to become landless labourers or to move to overcrowded cities to look for work. Here they lose their old ways, their cultural roots.

Footholds documents the plight of the *campesinos* and examines how Latin American research groups are investigating aspects of the *campesinos'* way of life, such as, farm tools, house construction, food, social organization, and communications.

Chanos chanos

The publication *Chanos chanos (the milkfish): a bibliography*, (IDRC-MR44e) lists the compilers as D.C. Ramsingh, W.E. Vanstone and Deborah Turnbull. IDRC inadvertently did not obtain the permission of D.C. Ramsingh (now Mrs Dorothy Vanstone) to use her name in connection with this publication. IDRC regrets this oversight and any inconvenience it may have caused Mrs Vanstone.



In addition to IDRC *Reports*, the Centre publishes a wide range of material on development issues. These include scientific monographs, reports, and bibliographies on specific IDRC research areas, as well as general interest literature. These publications represent research interests and activities supported by IDRC in agriculture, food and nutrition, population, health, education, information, and social sciences. Films describing the Centre and some of the areas of development research are also available. A catalogue of current material, publications or films, is available from the nearest IDRC regional office or from IDRC in Ottawa (see page 3 for complete addresses).

Publications may be ordered from the IDRC sales agents listed here.

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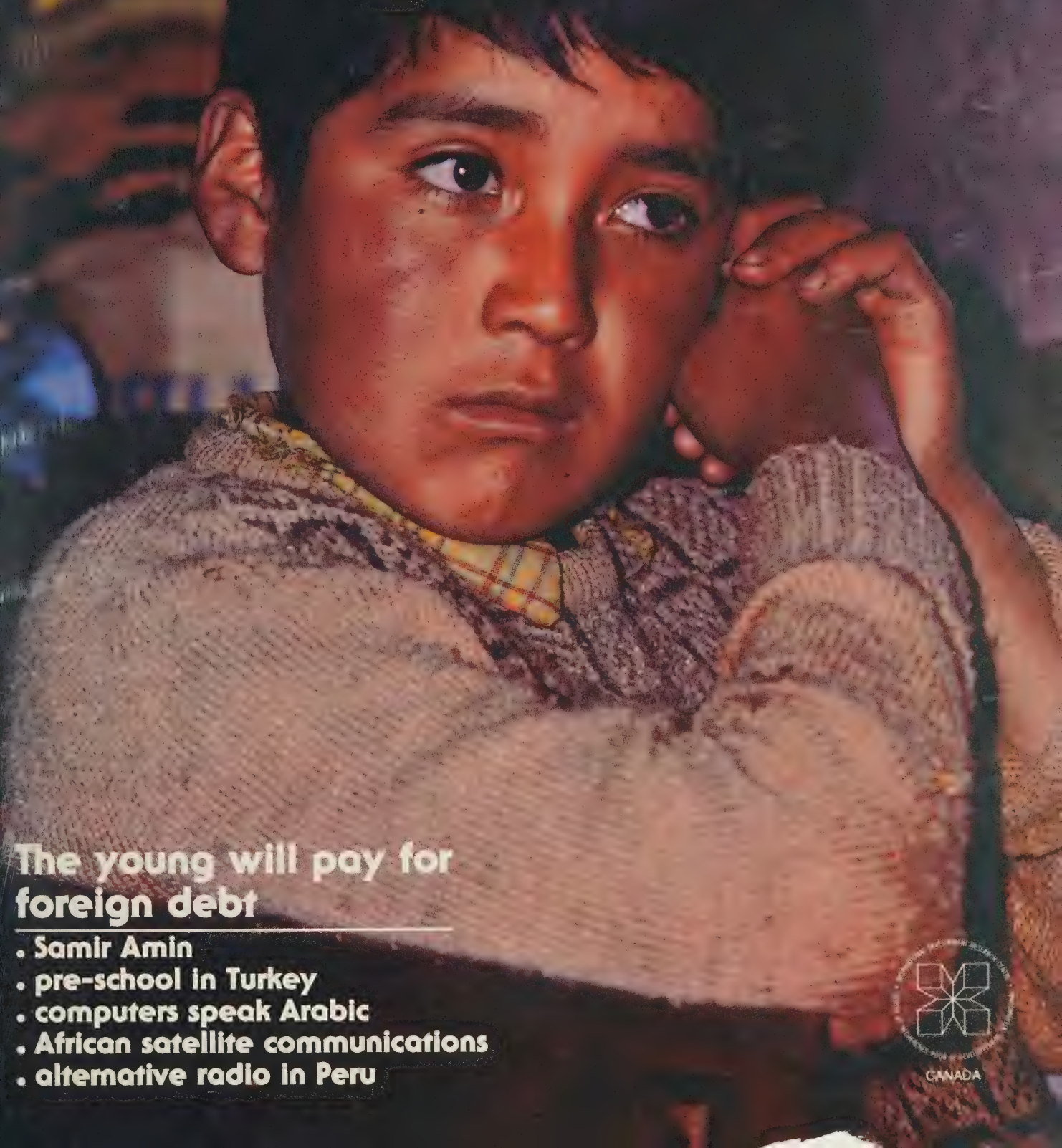
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Reports



The young will pay for foreign debt

- Samir Amin
- pre-school in Turkey
- computers speak Arabic
- African satellite communications
- alternative radio in Peru



Leaf nutrient and appropriate food technology

The potential nutritional benefits of employing leaf nutrient concentrate (LNC) to improve nutritional status, especially of children in less-developed countries, was recently described in your magazine (*Reports* 13(4) January) but an additional aspect of LNC technology has yet to be widely recognized.

Whereas numerous attempts over the last 30 years to introduce modern methods of converting greenery into edible food to subsistence farmers who need the additional nutrients have failed because the technologies were inappropriate, LNC technology is readily understood and recognized by rural communities. The fractionation of leaves into three components: a protein-rich concentrate; a fibrous residue; and a sugary liquor, uses equipment that can be manufactured locally and techniques that are easily accepted and implemented by villagers.

There are four reasons why LNC production is widely suited to improving the health and living standards of rural communities.

- Rural communities are often surrounded by leafy material, which is an underutilized protein resource capable of exploitation by leaf fractionation.

- Equipment for the entire process can be constructed by village craftsmen, and can be operated manually or by animal power. Fuel requirements are low and any fuel is suitable for the process.

- LNC is produced in

the communities for direct consumption. Production is decentralised and transport costs for both raw materials and products are, therefore, eliminated.

- The introduction of the process enables the farmers to expand their activities into secondary food processing using familiar raw materials, cultivation techniques, and technology.

Such a program is currently underway in southern Ghana, and further details are available upon request from the author.

Dr Peter Fellows
Oxford Polytechnic
Headington, Oxford, U.K.

Confirming reality

Reading Coming full circle in your January 1985 (*Reports* 13(4)) issue has been an enriching experience. The article underscores what should have been clear to rural development researchers/workers/policymakers: that the farmer knows his job better than anybody else; that he in fact has a vast store of knowledge and skills gained from his experiences in eking out a living from the land for himself and his family; that this treasury should first be fully tapped and understood by anyone interested in working with him. Thus, the top down approach to agricultural and rural development adhered to by many of our policymakers has proven ineffective in alleviating the conditions of the rural poor/small farmers in our country.

At present, our focus has been reoriented toward a more bottom up approach, or what is also commonly known as participatory research and development involving the

small lowland and upland farmers in the planning, implementation, and evaluation of different courses of action that will rebound to their benefit.

What seems, though, to be important is the process involved. There can be no shortcuts to development. Unless the farmers are truly involved and are convinced of the merits of such innovations or courses of action, there will be no assurance that whatever has been started will continue to flourish without the assistance of

"outsiders," that is, social scientists and the like.

I hope that your publication will continue to publish articles on this subject matter if only to keep us abreast with developments in other parts of the world.

Aurora Warque-Tabada
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Dr. Yelavarthy Nayudamma, a member of the IDRC Board of Governors since 1982, was one of those who died in the tragedy of Air India flight 182 on June 23, 1985. He was returning to India following his attendance at a meeting of the Executive Committee of the Board in Ottawa.

Dr. Nayudamma, who had been honoured by his own government with the title "Distinguished Scientist", enjoyed a towering reputation in international scientific bodies. He had occupied a number of high Indian offices, including Director General of the Council of Scientific and Industrial Research, Vice-Chancellor of Jawaharlal Nehru University, and Director



of the Central Leather Research Institute. He was the founder of the Committee for Science and Technology for Development (COSTED) of the International Council of Scientific Unions (ICSU).

Dr. Nayudamma leaves his wife (a physician), three children and a legion of grieving friends and associates.

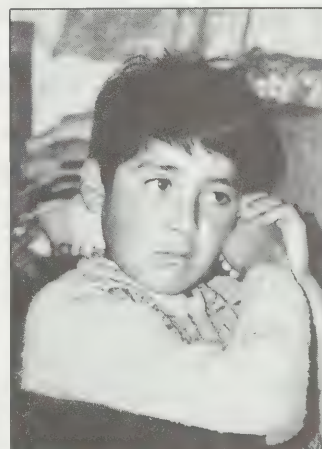
Reports

THE IDRC

The IDRC Reports and companion editions *Le CRDI Explore* and *El CIID Informa*, about the work of the International Development Research Centre and related activities in the field of international development, are published quarterly and are available on request from the Communications Division, IDRC, P.O. Box 8500, Ottawa, Canada K1G 3H9. *Editor-in-chief*: Rowan Shirkie. *Associate Editor*: Jacques Dupont. *Spanish edition*: Stella de Feferbaum. *Layout*: Alice Herczuk. *Staff photographer*: Neill McKee.

CONTENTS

Letters		2
Debt: the case of Chile	Ricardo Ffrench-Davis examines the origins and outlook for foreign debt in Chile and Latin America.	4
Banking on poverty	The role of international financial institutions in the debt crisis. Gilles Couture.	7
Popular development	An interview with Samir Amin.	9
A head start	Children of poverty need special preparation to succeed at school. Libby Bassett explains.	11
The electronic net	An information system strengthens ties between Arabic-speaking researchers. André McNicoll reports.	14
Space: a medium for peasants	Jean-Marc Fleury describes how Africa is overcoming its history of communications.	16
Communication and tradition	Researchers in Peru look for appropriate media content for marginalized people. By Wilson Ruiz.	19
Expecting to live	Mortality and its measurement can guide development. Steve Hunt explains.	21
Commentary	Including nutritional goals in agricultural research. By Per Pinstrup-Anderson.	22
Briefs	News and trends in development.	24
New releases	A film grows popular.	27



Cover picture: A young Chilean boy of the village of Liucura near Osorno: the debt crisis threatens the future of upcoming generations.

The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in five sectors: agriculture, food, and nutrition sciences; health sciences; information sciences; social sciences; and communications. IDRC is financed solely by the Parliament of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are located at 60 Queen Street, Ottawa, Canada (P.O. Box 8500, Ottawa, Canada K1G 3H9). Regional offices are located in East Africa (P.O. Box 62084, Nairobi, Kenya); West Africa (B.P. 11007, C.D. Annexe, Dakar, Sénégal); Asia (Tanglin P.O. Box 101, Singapore 9124, Republic of Singapore); South Asia (11 Jorbagh, New Delhi 110003, India); Latin America (Apartado Aéreo 53016, Bogota D.E., Colombia); and the Middle East (P.O. Box 14 Orman, Giza, Cairo, Egypt).

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Unsolicited manuscripts and other editorial materials are welcomed and will be considered for publication.

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DEBT

THE CASE OF CHILE

RICARDO FFRENCH-DAVIS

Most Latin American countries are confronted by a serious problem of foreign debts. The effects of this external shock on the economies of the debtor nations are varied. The diversity of effects depends upon the magnitude and rapidity of increase that characterizes the state of indebtedness of a given country, and the strategy that country adopts for development and borrowing. It is, in fact, this last that determines the level of development at which the crisis over foreign debt hits each country. In some nations the economy has stagnated or gone backwards over the last decade, as happened in Chile, while in others it grew vigorously on the basis of the abundant credit then available to them on the international markets.

The drop in export earnings and the problems with gaining access to markets in the industrialized countries combined to produce the most violent external shock to economies in Latin America in the last 50 years.

A HISTORY

The Chilean economy suffered from very low productivity in the period 1973-82. At the same time, there was a spectacular process of concentration of wealth and income. This was significantly linked with the foreign trade and financial policies imposed at the time: an indiscriminate liberalization of imports and the financial system. Such policy management resulted in indebtedness to foreign banks rising at an accelerated rate — about 60 percent a year from 1977 to 1981. The excessive increase in debt, rather than helping the process of internal capital formation, led to its being discouraged. There were powerful reasons for this:

- the rapid and indiscriminate liberalization of imports, especially consumer goods;
- the lag (appreciation) in exchange rates (A situation where in a rapid inflation the government devalues its currency against the US dollar slower than the rate of inflation so that US dollars — and consequently, imports — are cheap compared to local products);
- the persistence of high rates of real interest on the internal market; and
- the absolute liberty given to the "market" in determining the volume and application of Chilean and foreign funds, and the difficulty in identifying comparative market advantages or opportunities for productive investment.



All of this took place in market conditions determined by the application of a model distinguished by its extremism and the authoritarian setting in which it was possible to maintain it for so many years.

DESTINY AND DEBT

In 1982, the Chilean economy underwent a drastic readjustment involving a drop in the GNP of 14 percent. Since then the situation has been critical and depended upon the course of events connected to the foreign debt problem.

Although the Chilean foreign trade sector, from 1977 on, showed a high and rising deficit on current account, the large net inflow of capital permitted the accumulation of sizeable foreign currency reserves until 1981. The largest inflow was induced by the expansion of foreign trade, particularly imports of nonessential consumer goods. Capital movement concentrated to an alarming extent on bank credits to the private sector, given without any state guarantee. The total debt service reached 70 percent of goods and services exported in 1981 and 88 percent in 1982; this is three

times the coefficient for debt service in the years 1970-1974.

In 1981, more than 80 percent of the foreign debt was owed to banks and financial institutions; in 1974 their share was only 19 percent. Among nonpetroleum-exporting developing countries, Chile has become one of the major debtors in international private capital markets. In 1976 it ranked eleventh, but reached fifth place by 1981. In the overall Latin American context, the bank debts of Chile exceeded US\$1000 per person, as compared with a regional average of US\$600, and around US\$500 for Brazil. On the other hand, Chile's bank debts grew at a rate of 57 percent a year from 1977 to 1981, compared with an overall average for developing countries of 28 percent. As might well be imagined, neither percentage was bearable for any length of time. The responsibility for this situation must be laid at the door of debtors and creditors alike. The creditors often pressured the debtor countries to accept more credit and liberalize their indebtedness.

Such a massive process of contracting foreign debt as the one which occurred from 1977 to 1981 produces

significant effects in numerous areas of the national economy. The effects in Chile were intense: it contributed to a spectacular concentration of wealth, altered the operation of the savings and investment process, and had a decisive effect upon monetary and exchange policies.

The initial impact of the expansion of the foreign debt involved an increase in the availability of foreign currency. In fact, up to 1981 the net inflow of capital was greater than could be absorbed by the national economy.



The benefits of foreign credit are not realized by all in Santiago, Chile (left) and Guayaquil, Ecuador (right).

The deficit on current account grew constantly by large amounts: In 1980, the use of foreign capital reached an amount equivalent to 9 percent of the GNP compared to an average of 5 percent for Latin America. Despite this figure, the inflow of capital to private borrowers grew at an even faster rate. The resulting surplus (difference between amounts received and those spent) led to an increase in foreign reserves being registered until 1980.

This rapid accumulation of reserves had substantial effects upon monetary and exchange policy management, while the deficit on current account rose by leaps and bounds. At the same time, the large-scale movements of capital, both for use to finance increased expenditure on imports and what went to increasing the foreign currency reserves, meant that a very large share of all credit available in the economy originated in foreign funds.

The prevailing conditions in the world economy and the internal market, maintained a process of rising indebtedness, which, in turn, made Chile's foreign trade increasingly vulnerable. The behaviour of the real net debt, the ease with which further credit was to be had, and low rates of real interest on the international market induced a complacent attitude in many countries during the 1970s and the beginning of the 1980s. This was reinforced by the prevailing belief in Chilean official circles that since most of the debt was privately contracted, it would be efficiently used: the "magic of the marketplace" would see things

right. The result was that the Chilean economy became increasingly accustomed to a massive inflow of financial capital.

Meanwhile, what was going on in the production area was the opposite of what it was officially supposed to be. In fact, the rates of savings and investment were manifestly lower than those attained in the 1960s; the gross rate of fixed capital formation only reached an average of 15.5 percent of the GNP from 1974 to 1982, and in the best year (1981) it failed to rise above 20.2 per-

cent, the average recorded in the 1960s. A growing share of resources went for the consumption of imported goods, replacing expenditure on Chilean goods and internal savings. Except for some sectors which are intensive in their use of natural resources and luxury construction, investment ran into severe difficulty in identifying "comparative advantages."

When international financial problems arose in 1981, the deficit on the commercial account had risen to 11 percent or so of the GNP and the deficit on the current account to 21 percent. Consequently, the international financial and commercial situation deteriorated at just the time when the need to reduce the imbalance in foreign trade became inescapable.

Chile's difficulties in obtaining foreign credit coincided with a deterioration in the price of copper (a product which accounts for half of Chile's exports) and with an internal situation in which the need for new funds was very high. The government had dismantled the machinery for economic regulation, trusting that the dollar would regulate everything. The productive machinery was weakened and over-indebted. The result was that the effects of the external shock of 1981 multiplied inside the economy, and the GNP dropped 14 percent in 1982.

RESCHEDULING THE DEBTS

Chile found it increasingly difficult to gain access to financial markets, while its reserves, which were initially high, began to drop rapidly. Despite repeated

announcements that there was no need to reschedule the foreign debt, a long process of negotiation was initiated. The rescheduling was negotiated by the Chilean government, although most of the debt was owed by the private sector, and had no public guarantee.

As is usually the case in most rescheduling done in the last three years, this was preceded by an agreement with the International Monetary Fund (IMF). The terms in time and interest agreed with a committee rep-



resenting the hundreds of creditor banks were similar to those granted to Argentina, Brazil, and Mexico. To outward appearances, then, there is no substantial difference with the results obtained by Chile. However, the similarity of the terms obtained in the various cases contrasts with the fact that in Chile most of the debt was not covered by a government guarantee. This particular feature must have been a major element in the rescheduling process. Even more so if the private sector debtors were in no condition to amortize their debts over the period covered by the rescheduling. The truth is that the Chilean government granted a guarantee to cover 1983-1984 payments on the debt of Chilean financial undertakings not previously so covered, and yet did not thus obtain markedly more favourable conditions than other countries. From this one can deduce that the best card Chile had for getting better terms was thrown away.

The level of over-indebtedness in Chile is so serious that payment of interest and amortization, despite the rescheduling, absorbed about 12 percent of the GNP in 1983 and 1984. The tendency is, moreover, for the problem to worsen, since the amortization payments are scheduled to rise disproportionately in 1985. For the two-year period 1985-1986 the amortization payments will be 50 percent higher than they would have been without the 1983-1984 rescheduling. The increase is primarily due to credits used from 1979 to 1981. Furthermore, if the con-

ditions prevailing at the end of 1984 continue, interest payments scheduled for the next three-year period would amount to about 8 percent of the GNP. It is obvious that the mid-1983 re-scheduling faces up to only part of the problem created by the present economic policy. Combined with the deterioration that has occurred in international financial markets, it does not solve the problem posed by the size of the debt service which, from 1985, will keep the Chilean economy in a permanent state of uncertainty and dominated by questions of finance, at the expense of urgent and serious social problems and production.

OUTLOOK

The outlook for the years to come is negative. As is the case with developing countries in general, available projections indicate that Chile will experience a negative transfer of resources. That is, net credits will be less than interest payments. In conditions in which the "debt cycle"

operates normally, it is to be expected that debtor nations will eventually find themselves in a situation in which their net credits are less than their interest payments, and respond by reducing the volume of debt.

However, in this case, the situation is abnormal, since the negative flow of resources results from a sharp drop in the supply of credit and an unexpected increase in the rates of interest. The suddenness of the change and the fact that it was unexpected have also certainly been counterproductive, because it has caused a decline in economic activity, employment, and investment in the debtor countries.

The future that emerges is one of great scarcity of foreign credits and a drop in the capacity for growth over the medium term.

The serious problem confronting Chile over the foreign debt will require both internal and external action. The internal market must be set going again and reactivated; there must be a large element of Chilean content in

what is done; and a selective import policy must be put in place. This must be coupled with an export drive, a "realistic" exchange policy and an active search for new markets for non-traditional products. Regardless of the success of such efforts, the debt service is still an excessive burden. An economy weighed down by such a burden of debt, ultimately cannot develop and must, finally, become incapable of servicing the debt.

Consequently, the total debt balance must be reprogrammed (with some natural exceptions), "reasonable" rates of interest applied, and a large part of the payments must thus be refinanced.

Most of the debt is for credit granted to the private sector. In the case of credits granted by private foreign banks, about 80 percent of the total was not covered by a guarantee, nor was the interest. These credits, moreover, paid higher charges because they were not guaranteed. Secondly, in the present state of affairs, Chile would be paying more abroad than it received. These facts impose great pressure in the market, for the negotiation of a rescheduling not only of bank payments about to fall due, but also of the total real balance owed and the charges for it.

So far the schemes applied have been drawn up in an emergency situation by only one of the parties involved. They have in fact been highly favourable to the party concerned — the transnational banks — which not only wind up not losing by the crisis, but also gain advantages from the increase in margin resulting from financial intermediation.

This is yet another demonstration of the myopia of the banks, the same myopia that led them to blithely grant credit in the 1970s. However, no sooner were the rescheduling arrangements individually made with each debtor country through committees of bank and IMF representatives than various countries found themselves unable to meet the new terms agreed upon. The demands and estimates of the banks and the IMF turned out to be unenforceable.

If the economies of developing countries are to perform properly there will have to be changes in the approach to rescheduling. Some components of such a new approach would be an overall restructuring of the dates when debts fall due; a readaptation of the mechanisms of multilateral financing; a better balance between private and public sources of funds; and a review of the criteria for granting loans so as not to impose excessively deflationary policies, which turn out to be inefficient not only as regards the countries that are forced to apply them but also for the world economy as a whole.

Ricardo Ffrench-Davis is Director of CIEPLAN (Economic Research Corporation for Latin America). CIEPLAN, with support from IDRC has undertaken research on economic strategies for Chile (see sidebar).

CIEPLAN

It is a real challenge to find an explanation for and a solution to the double problem of inflation and recession in Chile and other developing countries. This, however, is what the Corporación de investigaciones económicas para Latinoamérica (CIEPLAN) (The Economic Research Corporation for Latin America) has been doing since 1981. It is a private nonprofit agency, established in Santiago, Chile in 1976. From its inception the group has had a clear objective: to carry out comparative socioeconomic studies of the experiences of Latin American countries, particularly Chile. Since then the interdisciplinary team, consisting mainly of economists and sociologists, has worked on identifying and analyzing the economic and social development problems of these countries so as to define strategies and policies for development. CIEPLAN specializes in macroeconomics and has staked out three priority areas of interest. The first is the study of the employment situation, poverty and the economic structure. The second is cooperation between States and economic integration. The last is the role of the State in economic policy.

Apart from its research activities, CIEPLAN trains young researchers by involving them in its work. It holds seminars and conferences, publishes, and cooperates with other agencies and with other Latin American researchers.

An ambitious research project, which began in 1981 with support

from IDRC, has as its aim the reaching of an understanding of the relationship between internal and external economic mechanisms in small semi-industrialized countries such as Chile, and the development of policy options to bring about a more stable economy in the country and a better economic situation for its population.

The program, which will terminate late in 1985, is divided into three phases. The first was given over to reaching a detailed understanding of the nature and impact of the neo-conservative strategy adopted by Chile. This task required the researchers to develop a broad range of sophisticated macroeconomic indicators for developing countries. In the second phase they tried to understand why the "automatic" macroeconomic strategy for stabilization doesn't work in Chile, why the prices of imports have risen faster there, why decreases in wages have not been followed by the creation of jobs. The third phase, currently in progress, consists of a detailed study of the effects of fiscal policy and the behaviour of the financial sector in the Chilean economy. The ultimate purpose of all of this is to prepare a macroeconomic model of the Chilean economy, evaluate the various strategy options for short- and long-term stability and analyze the medium- and longer-term consequences of the various policies. Researchers hope the results will be helpful not only to Chile, but to all developing countries faced with similar problems.

BANKING ON POVERTY

GILLES COUTURE

INTERNATIONAL FINANCING AND THE THIRD WORLD

According to statistics published by the Organization for Economic Cooperation and Development (OECD), in the two periods, 1970 to 1977, and 1977 to 1984, the foreign debt of Third World countries as a group rose from US\$72 billion to US\$244 billion dollars in the first period, and to US\$810 billion by the end of the second.

Between now and the end of the 1980s, the figures for the foreign debt owed by some of the Third World countries will reach record heights. Banks do not usually reveal the contents of their investment portfolios. Yet a 1983 study, by the Institute of International Economics in Washington, reveals the extent of involvement in commercial and industrial loans of the 13 largest American banks (out of about 14 500 in the U.S.A.) in five countries in Latin America (Argentina, Mexico, Brazil, Venezuela, and Chile).

Expressed as a percentage of their capital, overall, the CITICORP bank has granted loans to Brazil that amount to 73.5 percent of the value of its shares, a figure that rises to 174 percent for the five countries listed above. Figures for other major American commercial banks show: Bank of America, 158 percent; Chase Manhattan, 154 percent; Morgan Guaranty, 140 percent; Manufacturers Hanover, 262 percent; Chemical, 170 percent; Continental Illinois, 107 percent; Bankers Trust, 141 percent; First National Chicago, 134 percent; Security Pacific, 83 percent; Wells Fargo, 126 percent; Crocker National, 196 percent and First Interstate, 136 percent.

Another important phenomenon is that from 1982 to 1984, nonperforming loans by US commercial banks have increased by more than 20 percent a year. Nonperforming means capital loans and interest that have not been paid by debtors within 90 days after their due date.

NEW LOANS

The negotiations between Argentina and its creditors in the spring of 1984 over the country's arrears of interest mark a new stage in the rescheduling of the debts of Third World countries. The US commercial banks in effect agreed to grant a new loan so that a part of the interest due could be paid. This enabled them to avoid having their balance sheets for the third and fourth quarters of 1984 showing a sharp drop and being obliged to

declare that part of their loans were nonperforming. At the same time, four heavily indebted Latin American countries, Mexico, Brazil, Venezuela and Colombia, loaned Argentina another part of the sum due for interest. They are not taking any very serious risk because the U.S.A. undertook to pay them the amount after an agreement had been reached between Argentina and the IMF.

Additionally, on the credit side of the ledger of US commercial banks, medium-term loans are in the process of becoming long-term loans. So as to delay the due dates on debts owed to them, US commercial banks have issued long-term obligations on behalf of their offshore branches, which are involved in international finance. The consequence is that, in international operations, interbank financing is increasingly regarded as dangerous, since the US commercial banks at the moment show a severe imbalance in their statements that they must correct as quickly as possible.

Moreover, this quest for medium-term funds or deposits on the part of the US commercial banks adds to the current pressures on medium-term interest rates on the Eurodollar and Euro-Yen markets. As things are currently going, it is a mistake to believe that in the more or less long run, inflation will diminish the significance of the debts of Third World countries in the makeup of the balance sheets of the US commercial banks.

In such a situation, it is no surprise that the shares of the major US commercial banks did not keep pace with the stock exchange recoveries in New York in August 1982 and 1984. The profitability of US commercial banks is now very generally in doubt. The overwhelming danger of Third World loans is not the only reason for this, since US commercial banks also are faced with bad debts in the petroleum and agricultural sectors.

IF MEXICO COLLAPSES...

The menace to the international banking system, and especially to the US commercial banks, materialized in a dangerous form in August 1982 when Mexico found itself unable to meet its financial obligations. To declare that Mexico has suspended payment would have been tantamount to declaring Chase Manhattan Bank, City Bank, and several others virtually bankrupt. There is more. For some

months past, since the near failure of Continental Illinois, the US Federal Reserve Bank has been acting as a sort of guarantor of loans, thus endowing shaky loans with a cloak of respectability and encouraging banks to grant credit.

Very few of those who attended the 39th General Assembly of the International Monetary Fund (IMF) and the World Bank in September 1984, were not anxious about the course of the balances of the major US commercial banks because their credit balances are suffering severely from US monetary policy.

In the view of the financial experts present at that meeting, the decade of the 1970s was marked by a break in the continuity of international funding for development. International petrodollar credits and the quest of the multinationals in crisis for foreign outlets have led to a considerable increase in bank loans to the Third World and the privatization of the debts of Third World countries.

Since the beginning of the 1980s, there has been a falling off in the flow of private money to the Third World, and in 1982 petrodollars almost vanished as interest rates rose, and foreign trade stagnated. With these factors and the rising insolvency of Third World countries, coupled with the swing against them of the terms of trade (a drop in the purchasing power of most mineral, agricultural and forest products) have all acted to slow down private transfers to Third World countries.

Thus from 1970 to 1983, it has been above all the new industrial, petroleum-producing countries, essentially the intermediate countries in terms of income, that have received the essential credits from the international banks and, since 1974, have had the stimulus of commercial credits to cover the gap between deliveries and receipt of payment.

In the poorest countries, quite the reverse, more than 80 percent of loans come from public aid for development and export credits funded or guaranteed through the public sector. Direct and indirect assistance from multilateral aid programs of the members of the Committee for Development Aid (CDA) and the Organization of Economic Cooperation and Development (OECD) to some 36 of the poorest countries has doubled from 1975 to 1981, rising from US\$2.8 to 5.5 billion or from 0.07 to 0.08 percent of the GNP of the member countries of the CDA. This is very little compared to the loans granted by the international banks to developing countries, a figure put by the financial experts at more than US\$900 billion.

Moreover, in 1982, so as to offset the drop in international bank loans to Third World countries, the World Bank

**NONPETROLEUM-PRODUCING DEVELOPING COUNTRIES:
SHORT AND LONG TERM DEBT AND DEBT SERVICE; 74-81**

(figures in \$US billions: % ratios)

	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983
TOTAL DEBT	160.1	190.8	228.0	278.5	336.3	396.9	474.0	555.0	612.4	725.7
Short term debt	22.7	27.3	33.2	42.5	49.7	58.8	85.5	102.2	112.7	130.5
Long term debt	138.1	163.5	194.9	235.9	286.6	338.1	388.5	452.8	499.6	595.2
Ratio of foreign debt to exports of goods and services	104.6	122.4	125.5	126.4	130.2	119.2	112.9	124.9	143.3	155.1
Ratio of foreign debt to GNP	21.8	23.8	25.7	27.4	28.5	27.5	27.6	31.0	34.7	42.1
Payments for debt service	22.1	25.1	27.8	34.7	50.3	65.0	76.2	94.7	107.1	125.2
Ratio of debt service	14.1	16.1	15.3	15.4	19.0	19.0	17.6	20.4	23.9	26.8

SOURCE: Perspectives on the World Economy, 1984, OECD.

reordered its priorities and gave up its aim of combating poverty, in that it cut the funds given to its offshoot, the International Development Association (IDA), which specializes in interest-free loans to the poorest countries, and began to play the game more profitably for the private banks by participating in syndicate loans, co-financing and the issuing of obligations. The role of the IMF has also changed. In February 1983, so as to restore the credibility of Third World countries with lenders of international funds, the IMF refused to increase the Special Drawing Rights (SDR) of developing countries in financial difficulties, insisting instead upon readjustment plans before granting them further credit.

All bankers agree that the American and Japanese economies are centrally involved in the financial and monetary tensions just described. One possible resolution involves a progressive equalization of conditions and levels of activity in these two countries, leading, in the long term, to the domination of the world economy by Japan and the U.S.A. However, it is difficult to rule out a less-controlled outcome, involving the collapse of the world economy and a savage fall in the US dollar.

The principle that lies behind such a scenario is a rebalancing of the growth of the U.S.A. and of Japan, which will show up from 1985 on: steadily declining growth in the U.S.A. as compared to Japan, and a medium rate of growth in Europe.

Despite relatively high rates of growth in the developed countries, such a course of events will do nothing to resolve the problem of the Third World countries. In this scenario it is expected that the US commercial banks, between now and 1990, will try to bring the solvency ratios of indebted countries down to their 1979 level.

Following the same scenario, managing international credit in this way would result in an average growth figure for Third World countries ranging from 4 percent in 1985 to 1 percent in 1987. However, rates will differ sharply between different regions. From now to the end of the decade black Africa will show negative, or at best, zero growth. The same will be true of the Latin American countries except for Mexico. Mexico, close to the U.S.A. and other countries, which are themselves close to Japan, may be able to maintain their rates of growth constantly above 2 percent.

A strategy like this has nothing to do with a New Deal for the planet, nor with a Marshall Plan for the Third World. The combination of a Japan-U.S.A. rate of growth averaging 3.5 percent for the next few years, and lower rates of interest will maintain the status quo in the relationship between creditors and debtors. The international debts of the Third World countries will continue to be managed by piecemeal rescheduling. IMF pressure on countries in financial difficulty will not soften. This will not remove the financial threat to the US banks, but it will restrict it to separate countries and manage them by rationing the quantity of credit.

A DESIRABLE AGREEMENT

The conference of Latin American countries at Cartagena in June 1984, and the meeting of the IMF and the World Bank in September 1984 did not reopen the subject of case-by-case negotiation of foreign debt. They did, however, for the first time, point out the need for a framework to serve as the basis of individual negotiations. Two basic principles were laid down: the responsibility for finding a lasting solution was shared by all parties, and, the strain of recovery should be equally shared. A good many of those present treated the problem of the foreign debt

of the Third World countries as a political problem.

If, however, there is a major crisis in 1985 or 1986 in one or more of the US commercial banks involving one or more Third World countries and the payment of past due loans or interest, it is likely that the US government will intervene with the IMF, so that the country concerned gets a loan conditional upon its adopting a recovery program and that, in the last analysis, the US government will back the IMF or allow it to make loans to refinance its loans. In this light the significance of the vote by the Congress of the U.S.A. to share in an increase of the US quota for the IMF can be seen. The US government, like the US commercial banks, has no wish to allow a situation to develop in the Third World countries that could lead to suspension of payments.

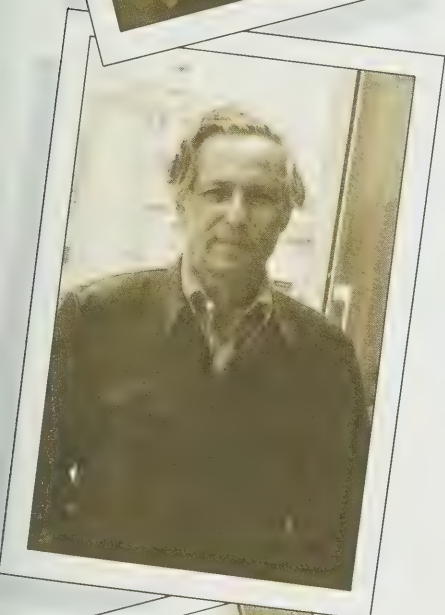
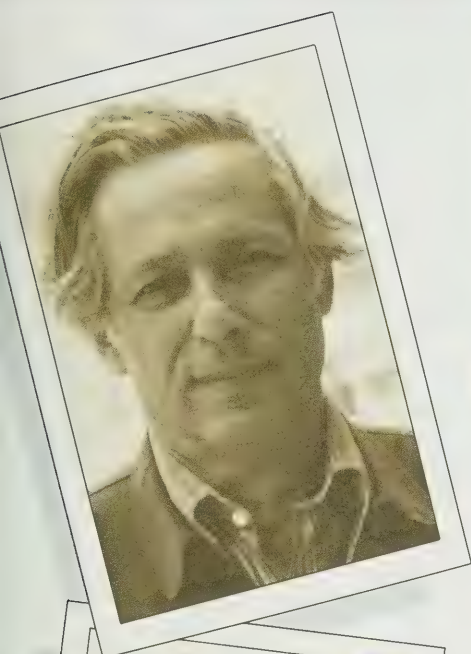
Thus the needs for refinancing of the most indebted countries are regularly met. There is, in fact, no limit to the functioning of this mechanism, since there is no institutional brake upon the international monetary system.

The truth is that the debts of the Third World countries have become an important element in the complex and huge pyramid of international credit, which just like the multinationals, is developing in a world climate that makes it quite likely that it will escape from national control, and, even more, from regional or international control.

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POPULAR DEVELOPMENT

DANIÈLE BLAIN



The economist Samir Amin is now the director of the Strategies for the Future of Africa program of UNITAR in Dakar (Senegal). He is the author of several books, including "Le développement inégal" (Unequal Development) and "L'accumulation à l'échelle mondiale" (Accumulation on the world scale). During the last fifteen years he has made a considerable contribution to upsetting accepted ideas about development problems, particularly by introducing such concepts as countries of the "centre" and "periphery" to clarify and orient discussion of development questions.

Ten years ago, in the course of a long discussion with a group of Italian journalists, Samir Amin and colleague André Gunder Frank, also an economist, talked about the then "artificial horizon for 1984" and put forward two hypotheses about the evolution of the world economy and the role that would be played by the developing countries. The first of these hypotheses dealt with the "redeployment capital project," that is, a new international division of labour in which large segments of the productive process, the classical production line industries, are transferred to the peripheral areas. Such a transfer would occur to take advantage of cheap labour and relocation close to expanding markets based on rising middle class demands: exactly the kind of development that occurred in Brazil during its peak phase. In this pattern of redeployment, the centre serves an unequal function, based on technological innovation and new industries, which include those that control assembly line industry.

The other hypothesis involved the failure of such redeployment: this is based on the supposition that the logic of capital controls and dominates the situation, not the negotiations between the centres and the periphery, which would encourage national industrial development open to the outside world. Resistance to redeployment would then produce a second model "even more negative," in which the assembly line industries are reconverted and, ultimately, centralized. The new transformed modernized industries arise in the central countries, and the South is marginalized in a framework of "extermination, racism and rising violence: the Third World becomes inconvenient."

Ten years later these two hypotheses constituted the basis for the interview that Samir Amin granted to Reports on the occasion of a visit to Italy to attend an international colloquium organized by the Pio Manzu Research Centre, which is concerned with the relations between the European and the Arab nations.

Reports: Mr Amin, how have the last ten years tested your hypotheses?

Amin: I think that we are, unfortunately, not very far from the realization of the two hypotheses in the Third World. On the one hand, there are the industrialized countries and, on the other, the marginal countries now referred to as the Fourth World. Effective redeployment of the assembly line industries has been the direction of the major Latin American countries, such as Brazil and Mexico, but also Argentina and others. The pattern holds in some countries in East Asia such as South Korea and Taiwan, and a few other centres in the Arab countries and South Asia. These redeployment areas in the newly industrialized

countries are, at the moment, in crisis because of other important factors: rivalries between Europe and America or Europe, the U.S. and Japan, the high interest rate counter-offensive that enables the U.S.A. to accumulate an enormous deficit without inflation. One of the results is obviously the worsening, to the point of becoming unbearable, of the burden of public debt in precisely those countries where capital redeployment was occurring successfully, quite the contrary of what the World Bank said when it foresaw development open to the outside. On the other hand, marginalization strikes, particularly, almost the whole of Africa south of the Sahara, where increasing famine is the plainest indication.

Reports: The present economic situation therefore obliges developing countries to try to adapt their economies. Can they?

Amin: You have used exactly the word I wanted to criticize, "adapt" their development to the new situation. That is where the development options lie: should partners simply try to adjust to the tendencies of world growth or, conversely, should they try to disconnect themselves from them?

The crisis the African States are passing through, and faring very badly, is simply the logical consequence of the type of development that has gone on there in the past. I think Africa entered a phase of prolonged crisis at the beginning of the 1970s, even before the 1973-1974 petroleum crisis. If one wants to set a date, it is rather the ending of the convertibility of the dollar in 1971 that marks the break off of the period of expansion and the beginning of the present crisis.

During the preceding period, the kind of development foreseen for Africa and the Third World in general was based on the worldwide expansion of the time. Consequently, it turned towards the outside world for the most part, and was based on giving a high priority to export products in agriculture, mining, and petroleum. It attempted to finance, with the income from exports, a small import substitution industry, supported by foreign capital or foreign public aid, and aimed mainly at the relatively well-off middle classes rather than the needs of the rural and urban people.

This kind of development produced the results that caused the collapses brought to light by the present crisis. It brought uneven development in the region: between those which, like the Ivory Coast, had a high growth rate but now find themselves with an intolerable foreign debt, and those which did not experience such growth, such as Burkina (formerly Upper Volta). It also brought a very uneven growth in terms of their internal society. The gap between town and country continues to widen, as does the gap within the towns themselves. Enormous shantytowns, even in quite average-sized cities such as those of Africa, reflect the wretchedness of the countryside as compared to the prosperity of isolated sectors.

Reports: But in that case, what options do the developing countries have?

Amin: It's no use being nostalgic about the 1960s, they are over, and I don't think we will return to them. In my opinion, there are two ways of confronting this crisis: the first is that

"That (IMF) policy is to re-establish equilibrium in a way that is entirely negative as far as the majority of people is concerned..."

alluded to by the word you used just now, to adapt, that is to say, to try to find a new place in the coming new system, which has not yet crystallized and whose details and results cannot yet be known. The other, quite the reverse, is to distance oneself from the system that is under reconstruction, and still unknown.

I am afraid that as far as most Third World countries, and probably the Arab and almost all the African countries, are concerned, it is not really possible for them to adjust to the system that is emerging except in the lowliest of positions. Consequently, they face a historic opportunity and challenge: can they, and on what terms, gain some distance from this system, and quite to the contrary, give priority to a style of development that I would define as "popular in scope," a national and popular construct. Please note that I am not saying "socialist": it remains to be seen if a popular approach can offer a margin of autonomy that will permit the people to undertake projects that are more consistent with social reorganization.

Reports: The repeated failures of large-scale development projects have led to the revision of certain concepts. Everywhere now, people talk about miniprojects, or down-to-earth approaches. Can this kind of approach favour the sort of national popular development you foresee?

Amin: I think all these ideas and projects are ambivalent. On the one hand, their social content is certainly very attractive, but on the other, they do not go far enough to carry through the conclusions drawn about the effectiveness of such a choice, either nationally or as regards international relations. The truth is that development cannot be a by-product of growth conceived without reference to the producers themselves, to their initiatives and priorities, to their needs and how they may satisfy them. But who would embark upon such a policy? So far as one can see, the international organizations do not have enough political power to start up such programs, nor does aid from the developed countries. Besides, I very much doubt that that is their true purpose. Is such a thing likely under today's political regimes? I

certainly do not believe it.

Put in another way, such a development presupposes that the problem of internal political change has been solved, and that another problem has also been solved, that of outside support for popular undertakings. How, in fact, does the West react to changes in the Third World? Often, the response to a change of this type has been the threat of invasion. One must be logical, one cannot simultaneously look forward to popular development and then, each time that relatively favourable political conditions arise, oppose them systematically. On the economic level, the main option resorted to by the West as a whole — not only the U.S.A. but Europe and Japan, which entirely agree as regards the Third World just now — consists of imposing IMF policy. That policy is to re-establish equilibrium in a way that is entirely negative as far as the majority of people is concerned, by applying so called "true prices." Internal social inequality is increased so as to reestablish the external equilibrium. It is not possible at one and the same time to speak of popular development and to try to impose through the IMF, the Group of Ten, etc., readjustment policies such as those conceived by the world system.

Reports: Ten years ago you formulated two pessimistic hypotheses which have, in large part been verified. What now?

Amin: One might well be very pessimistic about the short run, because there are effectively three factors to be seen. The logic of capital expansion which, in Africa, is marginalizing and crushing it. The logic of marginalization, which implies extermination, and the logic of the tool used to justify and legitimate it on the ideological level go hand in hand. The rise of racism in Europe is not a subsidiary phenomenon exclusively linked to the problem of immigrant workers and the demagogic policies instituted by the authorities in response to unemployment, it is also the logic that legitimates the notion of exterminating the Third World.

All of this is plain to see, as is the key to it all, a third element, which is the emphasis of the fear of war, a pre-war atmosphere that serves to justify the whole business. In the short run it is this that occupies centre stage and makes the outlook so dark. The darkness is everywhere. However, in the longer run, if there is no final explosion, there is no reason to be so pessimistic, because history has always gone along in this way. I cannot see any reason why it would not continue to do so. □



Photo by Libby Bassett

A HEAD START

PRESCHOOL EDUCATION IN TURKEY

LIBBY BASSETT

The politicians in Ankara had never seen anything like it. In the late 1970s, a petition with 60 000 names came before the National Assembly — more signatures than any other petition in the history of the Turkish republic. And what was surprising, in this land of male domination, was that all the 60 000 signatories were women. What drove so many women to action? Their desperate need for child day-care centres.

In Turkey, just 50 000 children out of eight million aged six or younger benefit from any sort of preschool service. The need for early childcare has become particularly pressing in recent years. In 1950, when 80 percent of the people still lived on the land, children were cared for by their mothers and other relatives. Today, with nearly 50 percent of Turkey's 50 million people living in urban areas, often in slums and shantytowns, many Turkish women work in industry and services. Their salaries cannot pay for childcare, so often the children are unattended.

Their desperate need for help led the women to petition the government. The Ministry of Education responded by announcing it would open preschools in shantytowns and rural areas. Soon afterward, a group of preschool educators led by Dr Cigdem Kagitcibasi (pronounced Chee-dem Kyaowt-chi-bashi) offered their services to the Ministry of Education. They were asked to prepare teaching materials for the proposed schools.

In 1978, Dr Kagitcibasi and her team began to study the state of early childhood development and educa-

tion in Turkey to develop working models and teaching materials — for parents as well as teachers — before widespread preschool education was launched in Turkey.

They finished their study and published their teaching materials (which are being used in some schools), but the plan to open preschools around the country was put on hold as the government changed several times.

Dr Kagitcibasi was disturbed that the growing need for preschool education was not being met. So, she proposed an experimental 4-year project to test a new method of giving underprivileged children a head start. She proposed a project to the education

There are, basically, three places where preschoolers could be found — in Turkey or almost anywhere. They could be at home, at a day-care centre (where they are supervised), or at a nursery school (where they would get an educational beginning). The experimental program is being applied in all three settings: in three day-care centres belonging to the Ministry of Monopolies, which runs state-owned factories; in three nursery schools run by private-sector textile and pharmaceutical factories; and in 93 homes. All in all, 271 children, now five and seven, have been studied for two years — with two years to go. Ninety-eight of their mothers get training; the other

development (such as grouping things together and classification), the complexity of their behaviour in play, and their personality and social development traits. One trait — the capacity to delay gratification — has been found related both to academic success and to successful coping strategies so necessary in later life.

In addition, all the mothers were interviewed at the beginning and end of the study as to how they perceived their children. Those with children in preschool programs were asked about the degree of communication between them and the school.

Each child also was assessed twice and his or her school records were



program of the Social Sciences Division of IDRC for funding, and in the fall of 1981, IDRC approved a \$105 000 grant for her Comprehensive Preschool Education Program (CPEP). The project began the following March.

Dr Kagitcibasi believes that if cognitive development is not supported in preschool programs by teaching self-confidence, independence, and initiative, then the child's gains may be short-lived. She feels the best way to foster a love of learning is to involve the family, particularly the mother.

In addition to using women with higher education, the project employs a number of aides drawn from the community to reach mothers and preschoolers. The concept of using semi-literate paraprofessional women from the communities is new, Dr Kagitcibasi said. "It may take a long time to get accepted, but I don't see it as impossible. Actually, it takes more organization than money."

... the best way to foster a love of learning is to involve the family, particularly the mother

173 are a control group to see — when the program receives its final analysis — what difference mother training makes in the child's ability to succeed in school.

The first year of the experiment was devoted to identifying and assessing the children — their IQs, cognitive

analyzed at the end of each school year. The final data for three-year-olds will cover a total of three years of preschool (which, in some control cases, will involve no schooling at all) and for the five-year-olds, three years of primary school.

At the end, the results of this study will be compared to those of adolescents who went through three years of comprehensive preschool education at one of the six centres used in Dr Kagitcibasi's experimental study.

During the project's first year, Dr Kagitcibasi and her colleagues learned of an Israeli program called HIPPY, or Home Instruction Program for Preschool Youngsters. Since its start in the 1960s, HIPPY has helped close the educational gap between the less-advantaged Asian and African Jews and those who came from Europe. The key to its success is family — particularly mother — involvement in the program. Its success led the Israeli

Ministry of Education to open a centre in 1982 to teach the HIPPY method to others.

Dr Kagitcibasi's colleague, Dr Sevda Bekman, was among the first to go for training at the centre, because it was felt the situation was similar in Turkey, where advantaged and disadvantaged compete in the same school system.

"The important thing about HIPPY is that they developed a weekly teaching program for two years. Because it had already been tried out with women in a lower socioeconomic system such as ours, we decided to adapt it, and not to reinvent the wheel," said Dr Kagitcibasi.

daughter and her mother-in-law, Havva.

Occasionally, said Dr Sevda Bekman, who arranged the meeting with Ayse and her family, husbands and mothers-in-law disapprove of the preschool experiment because it gives women a new sense of assurance and the traditional structure of family life changes. But grandmother Havva approved. She said it makes her happy when Sibel tells her stories and what she has learned. And she thinks it is good for Ayse to get out: "She should have some time to herself."

Ayse gets 10 000 Turkish lire a month (about CA\$30) for her work as an aide in the program. It is not much.

around long tables all day long singing songs, drawing, painting, cutting, and pasting. If the weather is good, they are marched outside to sit in a small courtyard with no play equipment. There is no formal preschool education program, "Just what the teachers bring in," said Dr Bekman, "and singing and storytelling are not education."

Sabriya Lacinkaya (La-chin-kaya), the good-natured nurse on duty, was somewhat despairing. She said the centre is always dark and unhealthy, the management does not provide a balanced diet and that it needs an education program. She said it is easy to spot the children in the CPEP program. "They are more enthusiastic about taking part in activities. They like to draw and paint."

Even in better equipped nursery schools, such as the one in the poor Zeytinburnu section, teachers also see a big difference in the children who are taking part in the experimental CPEP program. Seventy children whose mothers work at a private-sector textile factory nearby learn about colours, shapes, numbers, natural events such as rain and snow and, during our visit, about health and diet.

"The problem," said Nese Postalçilar (Ne-she Pos-tall-chilar), a young, well-educated teacher, "is that what most children get at our school just stays here." Miss Postalçilar said the children receiving extra help from their mothers through the CPEP program "are much more enthusiastic and take a leading part in activities. And, they know much more than the others."

Dr Bekman said, as we drove away, that "children attending custodial nurseries like the one we visited in Cibali are behind in every area of development compared with educational nurseries like this. By continuing the education at home we prepare the children so that when they go to primary school they will be ready to learn and will be more successful."

Dr Kagitcibasi said at the end of a day visiting CPEP sites, "If we can show that this program makes a long-lasting difference, then it will be important not only for Turkey but also internationally. Here, we are forming in the mothers new habits of reasoning and talking with the child."

"Our expectation," Dr Kagitcibasi said, "is that these changes will be self-sustaining once our experimental program ends because there will be continued support from the mother to the child."

The hope is that this experiment will prove so successful that Turkey's Ministry of Education will use it as a model for greatly expanded preschool training — for both mothers and children.

Libby Bassett is Director, Publications and Communications, World Environment Center. She traveled to Turkey recently to visit the Comprehensive Preschool Education Program (CPEP).

DESIGN				
	Custodial Day Care	Educational Day Care	Home Care	All
Mother Training	A) Three's: 24	B) Three's: 13	C) Three's: 16	53
	Five's: 19	Five's: 17	Five's: 9	45
No Mother Training	D) Three's: 31	E) Three's: 16	F) Three's: 38	85
	Five's: 35	Five's: 23	Five's: 30	88
	109	69	93	271

So, the HIPPY program for cognitive training was adapted for Turkey. Each week the 98 sets of mothers and children who are in the training program get a brightly multicoloured booklet with which to work. It includes a storybook a month, with corresponding material in the workbook. Each mother spends 15 minutes a day working with her child. For this, the mothers had to be trained to encourage cognitive development of the children by asking them questions and by providing information.

This program goes one step farther by including what they call mother enrichment — group discussions on topics important to the mothers and their children. These topics include nutrition, child care, discipline, how to avoid accidents, creative play, activities at home — and two weeks of family planning. The mother training develops their own sense of competence and self-esteem and provides group support to mothers so they can deal with everyday life and feel secure enough to provide freedom for the children.

This is considered both innovative and revolutionary because, said Dr Kagitcibasi, "It is an attempt to change family style in this culture."

Ayse Cevre (pronounced Aisha Chev-re), one of the 14 aides training other women, lives in the Zeytinburnu area of Istanbul, a section jam-packed with factories and slum houses. Her husband works in a coffee house, her nine-year-old son is in school, and she stays home with Sibel, her five-year-old

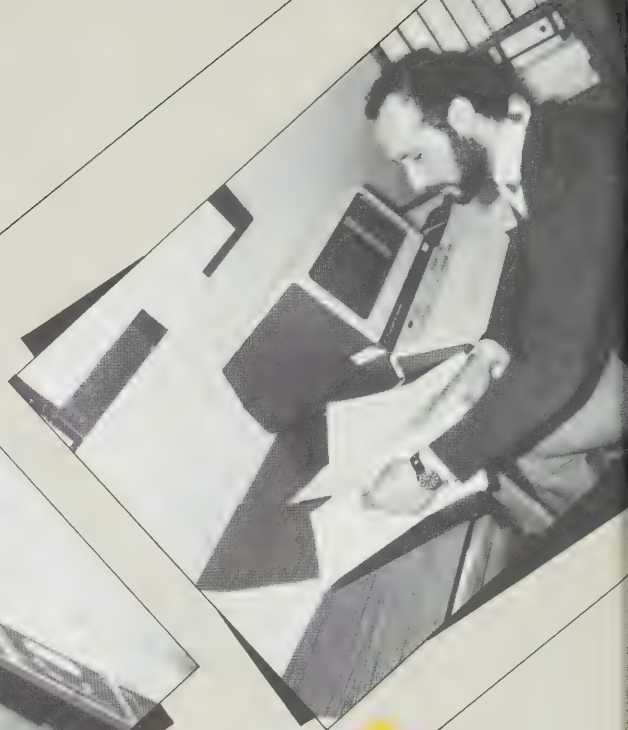
"If we can show that this program makes a long-lasting difference, then it will be important not only for Turkey but also internationally."

The cheapest apartment costs three times that much. She does it for her child and because she wanted to have something to do, to get out and to meet people.

Sibel is far more advanced than her nine-year-old brother since they began the home-study, Ayse said. "While I teach her, I have to teach him too. He doesn't know a star or a triangle. He says, 'Mommy, why didn't you send me to preschool?'" In some preschool centres in Turkey, he would have learned little more than how to sit still.

In Istanbul's Cibali section there is a typical centre for the workers' children at a 100-year-old tobacco factory overlooking the Golden Horn. In an equally ancient building with no playground and with cramped, airless rooms, 260 children — about 130 on each shift — are looked after by three teachers, 30 aides and two nurses. A doctor is supposed to be on staff, but he left some time ago.

The older children, four to six, sit



other Arab countries," he says, "and facilitate collaboration and communication."

MINISIS was developed by IDRC as part of its research program in information sciences. From the beginning, IDRC's Information Sciences Division has been concerned with techniques for the computerized processing, storage, and retrieval of published information — both to provide service to the Centre's own staff and to build the competence to advise interested institutions in the developing countries. MINISIS became operational in 1978.

But exactly what is MINISIS, and what is it about this computerized information system that earns it lavish praise whether at the CND, in Rabat, the Arab League in Tunis, or the Ministry of Education in Riyadh?

MINISIS gets the last part of its name from ISIS — the Integrated Set of Information Systems — a software package developed by the International Labour Office (ILO) in Geneva, and the first part from the scaling down of the software to run on small ("mini") computers. IDRC helped to install ISIS in several developing countries including Chile, Kuwait, Costa Rica and the Philippines. But ISIS functions best when used with a large IBM computer; it's expensive. MINISIS performs essentially the same functions as ISIS, but with the great advantage of not requiring large and costly computer hardware — hence it is "miniaturized," and aptly described in the first part of its easily remembered name.

The system was designed to run on the Hewlett-Packard 3000 series of computers, low-cost hardware much more compatible with developing-country budgets.

MINISIS was originally developed for the management of bibliographic data bases — library and scientific collections of published information — but with a flexible design that would permit it to have several other applications. The system, then, combines indexing and storage abilities and management facilities with information retrieval in one package. It is "user-friendly," that is, easy to learn and operate, even for people with little or no experience with computerized information systems. MINISIS also includes a set of programs to support library management and information handling in small- to medium-size libraries. There are processors for entering and retrieving data, for performing arithmetic computations, and for producing a variety of reports. It has powerful information retrieval capabilities being able to use several search descriptors, and supports the use of an on-line multilingual thesaurus. In other words, it allows the user to consult directly and continuously (the latter is what is meant by "interactive") with the list containing the thousands of terms used to store and file information.

One of the most exciting developments of MINISIS has been the translation of its language into Arabic, an absolutely vital step in its acceptance and use throughout North Africa and the Middle East. "In two years," predicts Fassi-Fihri, "most of the information available in this region will be in Arabic and it will have to be processed in Arabic." What is happening in the Arab-speaking world is that the whole computerized information infrastructure is being arabized — in part

There are more than 100 people employed at Morocco's modern and attractive key data-processing installation, the Centre national de documentation (CND), just outside Rabat, the capital. Their major resource is MINISIS, a multipurpose information-management system originally developed by IDRC. What MINISIS means for Morocco is that the country now has access to international information networks and it has collated and indexed its own important science and technology documentation. Moroccan scientists, researchers and other academics can benefit from one of the major resources available to their peers in Europe and North America.

"We progressed much more rapidly than we had anticipated," says its proud director, Ahmed Fassi-Fihri. Fassi-Fihri was asked personally by King Hassan II in 1968 to create a national documentation centre. "We already have 15 terminals, we had planned for only 11." What Fassi-Fihri finds especially exciting about MINISIS — in addition to better control over vital information resources — is that its "language" has been translated into Arabic. "This will bring us closer to the

MINISIS A COMPUTERIZED INFORMATION SYSTEM FOR THE DEVELOPING WORLD

because of the immense success of MINISIS.

In the second half of the last decade, there was a good deal of resentment directed against computer manufacturers in the West because they seemed to design their equipment for use in the Roman alphabet, if not exclusively for use in the English language. IDRC was sensitive to this, and as early as 1971 began working with the University of Montréal, Canada, on a small and very low-cost (\$125.00 CAN) electronic processor that could be applied to a variety of information transfer devices — from an Arabic typewriter to a sophisticated computer terminal. It was believed, and it proved to be correct, that widespread use of the device would result in better communication over a large area and at speeds now usual in the West, and at the same time preserve much of the aesthetic quality and tradition inherent in Arabic script.

There are two aspects to adapting a language's character set for computer use. The first is calligraphy. There must be some standard form for a character or idea, this form must be perfectly predictable — it cannot change. The second aspect is lexicography, which is the sequence in which symbols are ordered. This simply means that words must always be spelled the same way. It is this standardization that allows for the computerization of a language. Assigning each character or symbol a numerical value that is in turn translated into an electrical impulse allows the computer to process language electronically.

Once the problems of calligraphy and lexicography have been overcome (as has been done in the Arab countries, India, Israel and the Soviet Union), one must determine if the resulting character set conforms to international coding systems such as the American Standard Code for Information Interchange (ASCII) which yields 128 possible characters, or the Expanded Binary Coded Decimal Interchange Code (EBCDIC) which yields 256 characters. (When a language is conformable, it simply means that its constitutive elements, its characters, have been coded numerically.) Again, the Arab countries, India, Israel and the Soviet Union

have succeeded in conforming their languages to international coding standards.

All languages, whether they conform or not, are displayable either from right to left or from left to right, and further broken down into horizontal or vertical display. All that is required in the next step is that a keyboard be designed to support the new character set. This keyboard can then be used with terminals, teletypes, typewriters, even card-punch machines. At the Arab League's Tunis headquarters, all MINISIS command functions had been translated by the end of 1983, and it was expected that within the first quarter of 1984 all users' and operators' manuals would be arabized. The Arab League has already translated UNBIS (United Nations Bibliography System) into Arabic.

IDRC began a close association with ALDOC, the Arab League Documentation Centre, in late 1980 when the latter requested MINISIS for their work with socioeconomic information and data for the Arab League family. Mrs Faria Zahawi, head of ALDOC, sees a key role for MINISIS in the Arab Information Network now being set up. Between 20 to 30 Arab agencies and organizations will be involved in creating this important development-oriented organization, including such specialized agencies as ALECSO, the Arab League Educational, Cultural and Scientific Organization, and AIDO, the Arab Industrial Development Organization, in Baghdad. AIDO already has a MINISIS installation. There is now also a strong possibility that MINISIS will be installed at AOAD, the Arab Organization for Agricultural Development, in Khartoum.

The MINISIS group within IDRC provides support for installations around the world. This includes not only the maintenance of the system, but also the addition of new features to enhance its flexibility and power. Licensees become members of the MINISIS User's Group that pools information on new applications and common problems and advises IDRC on future developments. This is in keeping with IDRC's principle of making MINISIS available to developing countries and that any MINISIS software program be available for free.

The penetration and the use of computerized data systems such as MINISIS in the developing regions of the world is only beginning to be assessed. Morocco's CND alone has already trained some 65 specialists from Arab and francophone African countries in different aspects of computerized information systems.

The first developing-country MINISIS installation was at the Centre national de documentation agricole (CND) in Tunis, which went on to pioneer a number of agricultural information services within Tunisia's Ministry of Agriculture and is the national focal point for AGRIS, the International Information System for Agricultural Sciences, and CARIS, the Current Agricultural Research Information System. One of the most exciting uses of MINISIS in this field has been to store and retrieve information about agricultural land parcels for agrarian reform and land management. In Tunis, another recent MINISIS licensee is the Centre universitaire de documentation scientifique et technique.

The Arab League's involvement in the MINISIS network has had an important multiplier effect. There are many more MINISIS installations throughout Africa, for example, at the International Livestock Centre for Africa (ILCA) in Ethiopia, and the Service présidentiel de l'Informatique, in Zaïre, and the Office congolais d'Informatique, in Brazzaville. There are now several MINISIS installations in China, India, Malaysia, and the Philippines.

It is the system's low-cost and multiple uses that make it an unusually attractive proposition for developing countries eager to have their own computerized-information system. But it is what the countries themselves have been able to accomplish with this information tool that is behind the MINISIS success. They have been able to preserve their own documents, make these available to national researchers, and at the same time given researchers access to the same information enjoyed by scientists elsewhere. □

André McNicoll, senior writer in IDRC's Communications Division, recently visited MINISIS installations in the Middle East and North Africa to prepare this article.



INTELSAT V — the largest commercial communications satellite ever built has a capacity of 12 000 telephone calls and two television channels.

SPACE

A MEDIUM OF COMMUNICATION FOR AFRICAN PEASANTS

JEAN-MARC FLEURY



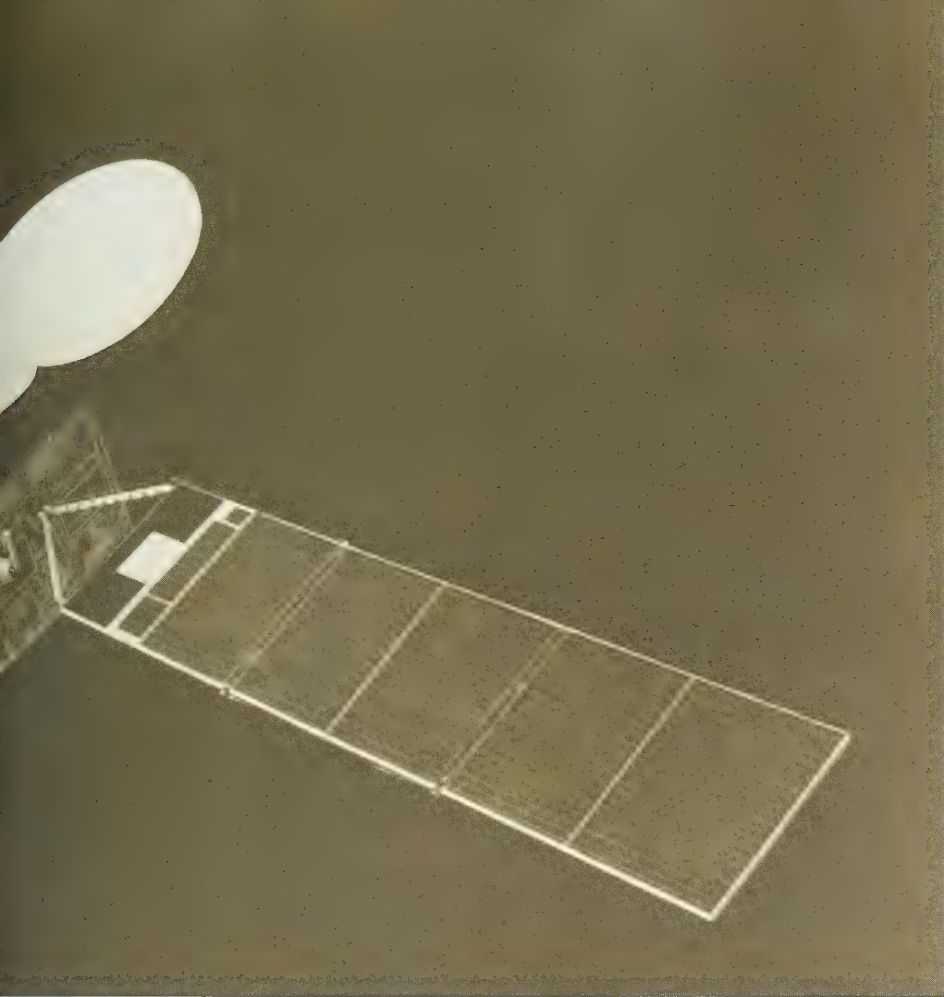
Satellites bring solar powered television to rural Nigeria

When he was president of Guinea, Sékou Toure used to like to astonish his guests with his wireless telephone. In November 1982, when the Organization for African Unity (OAU) was going through a difficult time, he asked, while seated at the table at mealtime, "Get me Houphouet (president of the Ivory Coast), Mobutu (Zaire), Eyadema (Togo) or Kadafi (Lybia)." And the call went through quickly.

When communications inside a country are possible, they are sometimes more expensive than communications with the outside. For example, in Niger, a telephone call to a city inside the country costs three times as much as a call to a foreign capital, which is three times farther away.

Generally speaking, although chiefs of state and more and more Africans in the cities have ready access to a telephone, people in the country must travel kilometres before finding one.

The extent of telephone service in a country is measured by the number of lines per 100 inhabitants. In Africa it is the lowest, only 0.4; in Asia it is 5.3; and in North America it is 73.6 (figures for 1978). On the African continent, four out of five telephones are in the cities, especially the capitals, although only 20 percent of the population lives there. Reaching someone in the interior, outside the major centres, is a gamble. The Senegalese daily *Le Soleil* said that out of about a hundred calls for Thiès, the third largest city of



Senegal, only about fifteen resulted in a conversation.

The lines of most national networks are saturated very quickly every day, so it is a good idea to arrive early at the office if you have a call to make to the interior. Since too often it takes days to get a call through, users tend to think of the telephone as a kind of postal service.

These communications difficulties have forced many firms to invest in their own radio network. These parallel networks sometimes assume considerable importance. As for individuals, they fend for themselves. Nothing is more useful than a friend who works for a big company, a tobacco multinational, for example, who must maintain permanent contact with his or her salespeople. Or a friend who works in the army's communications sector.

Much progress has nevertheless been made. The African continent, because of its size and low population density, poses a special problem. At the beginning of the 1960s, it was thought that the solution lay in a network of decametric wave (short wave) stations. A few years later, it was realized that the very weak capacity inherent in decametric waves would make it impossible for these stations to ever meet the needs.

In order to increase the output, centimetric wave (microwave) transmitters were required. However, microwave signals cannot follow the curvature of the earth and it was necessary to install microwave link stations every 30, 40, or

50 kilometres — a real challenge on jungle terrain.

PANAFTEL, the Panafrican Telecommunications Network, was set up under the aegis of the International Telecommunications Union (ITU) during the 1970s. The objective was to crisscross the continent with 20 000 km of radio-relay routes, controlled through 18 international automatic switching centres, which would constitute the nodal points of this vast network. The "Africa 50" would thus finally be able to speak to each other without an intermediary.

The continent has inherited a star-shaped communications structure, and the heart of the star is the former colonial capital. According to Alassane Ndiaye, the chairman and managing director of TéléSénégal, the Senegalese international telecommunications company, "in Francophone Africa, the telecommunication network consisted of branches directed toward the capitals of the former colonial powers, where all important decisions were made." That is why a call placed by a citizen of Dakar to someone in Banjul, the capital of Gambia, was relayed through Paris and London, although Gambia is entirely surrounded by Senegal!

The example of Brazzaville and Kinshasa, which are the capitals of the Congo and Zaire, respectively, and which are both located on opposite banks of the same river, was almost ridiculous. Telephone connections were made through Paris and Brussels,

and yet between Brazza and Kinshasa the river is only 4 km wide. Although the two cities are able to speak to each other today, they do so only through Paris or Brussels. According to the experts at the ITU office in Dakar, even at the end of the 1970s, West Africa had only three interafrican connections: Burkina Faso/Ivory Coast, Togo/Benin, and Benin/Nigeria.

In spite of very great difficulties, some of which have not yet been overcome, the PANAFTEL network has enjoyed spectacular development, especially since 1980. Moreover, each year lengthens the list of notable improvements.

For example, PANAFTEL's 20 000 km of international microwave links are almost completely installed. To this must be added as many kilometres of national microwave links. Furthermore, according to the ITU, 26 countries already have an international automatic telephone exchange. In fact, it was possible to reach Montreal or Ottawa from Dakar by direct dialing long before Canadians could reach Senegal in the same way.

While the radio relay systems were being extended, other technologies were being applied. The Casablanca-Dakar underwater cable, which was brought into service in 1977, was extended to Abidjan in 1978, and to Lagos in 1980.

Today, the ITU experts deny having stressed microwave links, but they seem to have been taken by surprise by the phenomenal growth in satellite communications.

MANY PATHS

"Until the end of the 1970s," Alassane Ndiaye recalled, "there was great enthusiasm for microwave links, but not enough stress was placed on the complementarity of the three systems: underwater cables, microwave links, and satellites. At that time, I said that it would be necessary to combine these three means for economic, human, and technical reasons. Any proposed network should allow for the lack of technicians, limited financial resources and the precarious condition of the roads."

Mr Ndiaye acknowledged that microwave links are attractive in some cases, "especially on channels with heavy traffic." Microwave technology also makes it possible for users in the regions it crosses to plug into the national network. However, the supply of energy to the generators and maintenance have posed considerable difficulties.

Several times a year, trucks must supply the generators with gas or fuel. A road must be built the length of each microwave link, a road that sometimes is used only from time to time, the time it takes the rain to wash it away. This is very expensive, especially for a developing country. In Niger, some stations already operate on solar energy. Guinea, too, is getting ready to introduce solar energy, according to Moro Sangare,

maintenance chief for the microwave links at Conakry and an advocate of this technique. "Our problem" he acknowledged, "is maintenance. Three-quarters of our failures are power failures. That is why, starting in January 1985, we expect to have about ten stations operating on solar energy."

Canada, which has made a major contribution to the completion of PAN-AFTEL by financing the Benin/Burkina Faso/Mali/Senegal sector, has a good knowledge of these problems. The recipients are thankful, but they do not have the staff and revenues to maintain the radio relay stations. When a station fails, the whole network ceases to function. Often, it must be backed up by a satellite link, especially between Dakar and Bamako (Mali). In Zaire, tens of millions of dollars have been lost in a 2500-km radio relay system. The stations were simply swallowed by abundant jungle vegetation. Today, this country has set up REZATELSAT, a network of 13 earth stations connected by satellite.

Satellites — the technology becomes more and more practical. Perhaps it is satellite technology that will finally bring communications to both rural and urban Africa.

FORTY-FIVE COUNTRIES

The continent already has more than 80 earth stations, large (32 m) and small (10-11 m), which provide secure communications through space. Forty-five countries have at least one antenna aimed at a satellite. Some countries have several: Zaire has 13, Sudan 14, Algeria 15, Nigeria 20, and so on.

If you visit the large earth stations of Zamengoé, near Yaoundé in Cameroon, or Gandoul, 40 km from Dakar, an engineer will show you the modules that make it possible to ensure a direct international link. The system is easy to understand: the name of each country appears on the module. Nevertheless, the volume must be sufficient for operations to produce some profits. At present, some buildings in industrialized countries have more telephones than many African countries. In the meantime, Cameroon and Senegal can still reach Kenya by satellite, but sometimes the call will still be made through Paris or London.

Except for Algeria, which uses the InterSputnik satellites, all the African countries use the satellites of the International Telecommunications Satellite Organization (INTELSAT), which was founded in 1964. Several even rely on INTELSAT for their domestic links: Algeria, Morocco, Niger, Nigeria, Sudan and Zaire. Moreover, the Ivory Coast, Ethiopia and Uganda have announced their intention to do likewise.

France, which builds satellites, has protested through its minister of postal services against the renting by INTELSAT of its excess capacity to certain states of the Third World. Every satellite in geostationary orbit is accompanied by a "spare wheel," which

consists of another identical satellite ready to take over at the first sign of a breakdown. The circuits of these spare wheels can be rented, subject to cancellation, at very favourable rates.

But the main threat to INTELSAT comes from the country in which it originated and in which by far the greater part of its shares are held; the U.S.A. When the time came for deregulation or liberalization, which the Reagan administration touts, several American companies asked for permits to set up satellite links between America and Europe. It is, in fact, the transatlantic satellite traffic that is the most profitable and INTELSAT has a monopoly of it.

One ought to say "had" a monopoly, because on 29 November last year, President Reagan authorized American firms to offer international telecommunications services by satellite and unilaterally put an end to INTELSAT's monopoly.

"So far," says Mr Ndiaye "INTELSAT has managed to apply a single tariff,

*Some buildings in
industrialized countries
have more telephones
than many
African countries*

regardless of whether one transmits to Fiji, Canada, or Senegal, even though there is very little traffic to some places. Places with heavy traffic subsidize those where there is little. Satellites reserved for exchanges between Europe and America may very well upset the spirit of international cooperation which is the very basis of INTELSAT."

At the moment the organization, whose headquarters are in Washington, has 109 member states and can be considered a great success for international technical cooperation. In 1965 INTELSAT leased a telephonic connection for US\$32 000 a year. By 1977 the cost had dropped to US\$7380 and it is now US\$4740. Excess capacity is even cheaper. When the new satellites of the INTELSAT VI generation begin to be placed in orbit, their enormous capacity should lead to another drop in the price.

"The problem," Alassane Ndiaye points out, "is that if these companies skim off the cream of the traffic, INTELSAT will be forced to lower its

transatlantic rates so as to compete." Certainly, the loss in earnings will have to be made up by the rest of the network. "One can be certain that we will not be able to go on dropping the rates. In other circumstances, one could expect there to be sizeable reductions."

IS THE SOLUTION AN AFRICAN SATELLITE?

According to the chairman and managing director of TéléSénégal, "One thing that is certain is that there will be an African satellite for inter-African communications. However, this will not prevent the African countries from using a world system for their intercontinental communications."

The intention of the African countries is clear. Delays are due rather to the fact that there are plans for too many African satellites. The African Postal and Telecommunications Union (APTU), which has the shortcoming of comprising only Francophone countries, is planning AFSAT. The Pan African Telecommunications Union (PATU), an agency of the OAU, is defending the AFROSAT project. The countries of the Arab League will soon be acquiring the ARABSAT system. Nigeria, which is tempted to go it alone, is said to have been offered a satellite by Canada in exchange for oil. Even the International Telecommunications Union (ITU), an agency of the United Nations, has proposed a system intended only for rural telecommunications (AMIT/IRD/GLODOM project). INTELSAT for its part has just counterattacked by offering free circuits for experiments in health and education by satellite in connection with the American SHARE program.

An encouraging sign, however, is that the ITU, APTU and PATU are beginning to cooperate. The objective is to set up a real regional, African system of telecommunications by satellite.

The technology is developing so rapidly — for example, NASA engineers have undertaken the construction of an antenna with a diameter of 100 m which, in conjunction with a satellite, would relay the signals of wrist radios — that the decision to commit hundreds of millions of dollars today would be foolhardy. About US\$200 million would be required just for the equipment in space: a satellite in geostationary orbit accompanied by another "spare wheel" satellite, with a "reserve satellite" on the ground. Earth stations would require even larger expenditures.

In any case, the African countryside will probably never be dotted by telephone poles. When service is provided to rural areas in Africa, it will be done through space. Who knows? The wireless telephone will perhaps become as commonplace as the radio-cassette-player.

Jean-Marc Fleury is regional liaison officer of the Communications Division of IDRC, based in Dakar, Senegal.

In Peru, vigorous efforts are being made to look for alternative means of communication for marginal social groups, particularly those that master neither literacy nor Spanish, the national language. The interests and requirements of these groups are not the same as those of the dominant economic powers. Educational programming cannot only help people to better the physical aspects of their lives but can help them learn to see themselves as people with the power to bring about their own development.

Peru is an enormous country with a difficult geography and a widely dispersed rural population. In the coast, large tracts of desert separate the fertile populated valleys. In the Andes mountains, the peasants live in areas of difficult physical access. Radio communication has become the most powerful mechanism to reach the rural populations. Its impact is especially felt in isolated communities without roads, electricity, television, postal service or telephones.

Peru's countryfolk awake at 4 a.m. Sitting around an open fire which serves as stove, they begin their day by turning on their main means of communication with the outside world — an inexpensive transistor radio. Most of the time radio stations transmit soap operas, international hit music, and advertisements. Native music programs are broadcast at the least popular times. Educational programs concerned with improving agricultural production or providing information about public services are almost nonexistent. Radio stations in Peru are the monopoly of private firms dominated by the profit motive and with limited concern for the maintenance of native culture.

One of the few alternatives to commercial radio is provided by the Centro de Estudios Sociales (CEPES), a non-profit multidisciplinary research and action centre. Every morning from 5 a.m. to 6 a.m., and on Sundays from 5 a.m. to 7 a.m., CEPES' radio program "Tierra Fecunda" (Fertile Land) reaches more than five million Peruvian peasants. The most important feature of this alternative program is the participation of the audience in formulating the message. "Tierra Fecunda" chooses its subjects in consultation with the audience. It can be a burning problem of the locality such as a dispute over a plot of land, or the misdeeds of the local bully, but above all, the

broadcasts have relevance and interest for their audience. It deals with issues and problems facing rural areas.

"Our goal is to restructure radio communication from a one-way flow to a two-way flow, in other words from the people to the people," said Leo Castillo, a former truck driver who is now a key member of the "Tierra Fecunda"

COMMUNICATION AND TRADITION

WILSON RUIZ

Photo by CEPES from Peru



Tierra Fecunda's Leo Castillo recording on location in the Peruvian Andes

production team. "To accomplish our goal we now have a network of 830 volunteer reporters who cover the entire country. We also receive from peasant communities thousands of letters that are read and discussed on-air. In addition, through the use of a mobile unit, on-location interviews are recorded and broadcast daily."

Recently, with a grant from the IDRC education program, the production team responsible for "Tierra Fecunda" conducted a study which examined the range of radio programming aimed at rural populations, and evaluated the impact of this programming. Their first step was to organize a series of regional workshops with the volunteer reporters. At the same time, discussions with production

teams from other alternative radio programs aimed at rural populations took place in several Peruvian provinces. "We met with 12 production teams, and agreed to exchange programs and experiences on a regular basis," Cristobal Goldschmidt of "Tierra Fecunda" explained.

The study continued with a survey in three rural areas of the country: Huamachua, La Libertad, in the north; Huaraz, Ancash, in the centre; and Puquio, Ayacucho, in the south. The fieldworkers visited dozens of communities where they interviewed leaders, teachers, volunteer reporters, and radio listeners in general. The interviews were recorded on cassettes, and later on the same day the entire community had the opportunity to listen to them and to discuss them.

"The idea of playing these interviews back for the entire com-

munity came out of our first workshop with the volunteer reporters," Goldschmidt said.

The interviews attempted to ascertain the extent to which rural populations listen to "Tierra Fecunda," the usefulness the programs have for them, and the comparisons they make between this alternative radio program and commercial ones. The general consensus was that "Tierra Fecunda" is the only radio program which gives peasants the opportunity to express their views on-air. The extensive use of the native Quechua language in the program was another popular feature among those surveyed. By far the favorite portions, according to the listeners, were those which broadcast traditions and stories of the various communities and native music.

"These broadcasts make us realize that our traditions and music have relevance to the

present and will live on despite a cultural colonization process which attempts to deny us the right of expression," a volunteer reporter in the province of Ancash said.

The CEPES study showed a surprisingly high penetration of radio programs in the rural areas, despite the poor infrastructure of radio stations. One of the most important results of the study was the discovery that listeners would like to hear more cultural messages as well as music and poetry in the radio programs. This need is particularly serious given the position Indian groups have in Peruvian society. Peru is a country with a high degree of internal colonization, where Western values are preferred and Indian culture is scorned, or at best, is ignored by the minority middle and upper classes.

An intrinsic element of Indian culture is Quechua music, which conveys not only rhythms of the popular culture but also the collective history and the highest values of a now sub-

jugated group. Not surprisingly, CEPES saw the pressing need to rescue Quechua songs in order to keep alive a vital element of Indian culture. The production team of "Tierra Fecunda" saw a much more practical side: the necessity to incorporate Quechua songs into its radio program to enhance its appeal. Again, with the financial assistance of the IDRC, CEPES initiated a project which would compile Quechua songs and then broadcast them on rural radio programs.

Anthropologist Rodrigo Montoya, himself an accomplished musician and well-known interpreter of Quechua songs, as well as a professor in the Anthropology department at Lima's San Marcos University, headed the project. He was assisted by his two brothers, Luis, an anthropologist, and Edwin, a musician. The three Quechua-speaking fieldworkers visited eight highland regions where Quechua songs predominate. They compiled over 700 songs and classified them

by themes — love, nature, migration, social protest, etc. All songs were recorded as played and sung by the local interpreters of the selected regions. In addition, the Montoya brothers consulted written sources, which included private musical collections, monographs by local musicians, and popular song books.

Alternative radio programs which broadcast Quechua songs and other items of interest to Peru's marginal groups, recognize the relationship between communication, education, and the social, economic, and political context in which they develop and function. However, as in most other developing countries, television in Peru is the most important cultural medium today. But the content of television in this South American country, for the most part, consists of soap operas, canned U.S. reruns, local talent sitcoms, and variety shows. Unfortunately, the educational role of television, either in the formal transmission of specific

knowledge and skills or in the more informal inculcation of beliefs and values, is almost totally ignored. The Centro de Estudios y Promoción del Desarrollo (DESCO), a private non-profit research centre operating in Lima, has become concerned with the question of alternative content for television. In a study undertaken with the assistance of the IDRC, DESCO looked into what this alternative would comprise and how it would reflect the language, values, and subject areas of interest to the socially and economically marginal populations.

highest rating in Peru was all locally produced "sitcoms." Their popularity was attributed not only to the entertainment value which they generate, but also above all to the use of national humour. Comedy allows these programs to openly and bluntly discuss the country's everyday realities. The sketches touch on subjects which are considered taboo on informational or news programs. "Unfortunately, they also tend to exploit social and cultural stereotypes which perpetuate the existing social order," Peirano said.

The study also showed that at present Peruvian television tends to degrade the image of poor people. The danger of putting television at the service of the dominating class and culture is that it is likely to impede the full intellectual social and economic development of the great majority of people. It is also likely to retard the reasoning power and self-confidence of the populations outside of the mainstream.

Through interviews with actors, producers, scriptwriters, and live audiences, the researchers examined the impact of the values being transmitted by the sitcoms, and the identification of people in the marginal sectors with these values. "The programs explain social differences as a consequence of race. Occupations and social status appear as an intrinsic consequence of race. In this pecking order, Indians and mestizos are always subordinated to the white man," Peirano explained.

What TV should do, according to Peirano, is use popular culture as an educational device to disseminate information which will encourage marginal groups to achieve badly needed social and economic development. "The common argument that commercial TV gives people what they want is based on a fallacy. How can they desire programs they have neither been shown nor offered?" Peirano said.

Alternative radio programs offer marginalized people, such as the Quechua Indians of Peru, their sole access to the media which are shaping the cultural identity of their society. For instance, CEPES' radio program, "Tierra Fecunda", helps them to preserve Quechua music and songs, to counter the Western influence of the middle-class controlled media, and to express their contemporary experiences through songs and other programs on the radio. While these small projects, funded by IDRC, show the potential the media have in encouraging development, the sad reality of mass media in Peru, as elsewhere in the Third World, is that they rarely serve the needs of the ordinary people. □

Wilson Ruiz is a Chilean-born freelance writer. He recently visited the education-communication projects in Peru for this article.

Photo by CEPES from Peru



Quechua music reflects the collective history of a now subjugated group

knowledge and skills or in the more informal inculcation of beliefs and values, is almost totally ignored.

The project, headed by DESCO's sociologist Luis Peirano, discovered that the television programing of



EXPECTING TO LIVE

STEVE HUNT

Recent trends in developing countries indicate the rate of increase in life expectancy has slowed or stagnated at unacceptably low levels.

After the Second World War the average life span of a person living in a developing country leaped ahead. For example in Latin America a child born in the mid-1970s could expect to live, on average, for 62 years compared to 52 years in 1950. The average life span jumped 15 years in Asia over a similar period and 10 years in Africa.

Individual countries experienced even greater improvements. Life expectancy in Sri Lanka jumped 18 years and in Mauritius grew to 56.7 years from 42.7 years between 1946 and 1952.

The phenomenal rates of growth in the average life span exceeded any in history and provide a picture of an optimistic future for developing countries.

"It may not be too much to hope that, within a decade or two, the vast majority of the world's people will have an expectation of life at birth of 65 years or more", suggested an authoritative UN report on mortality in 1962.

The United Nations projected in 1963 average life span would increase at a rate of half a year annually during the 1960s and .58 years annually during the early 1970s. The UN projected the 1960s relatively accurately but did not anticipate the following decade. Instead of a steady increase, the average life span grew at a much slower rate of .4 years annually and in some countries levelled off completely.

If present trends continue, the average life span in many developing countries

may never reach a level comparable in the West. While Latin America may level off at an average age close to North American standards of 70 years, African countries may never do better than their current 46 year average.

The life span is so short in developing countries because of the high mortality rate for children. Child deaths in developing countries account for 40 percent of all deaths. In some cases infant mortality rates are 15 times higher than in developed countries. In many African countries one in four children does not survive to his or her fifth birthday.

Earlier optimism expressed by the UN was based on the effectiveness of modern medical technology. Modern medicine was assumed to improve mortality rates without necessarily improving social and economic conditions. But researchers are beginning to realize mortality is not just related to inadequate levels of health care but is linked to poverty and social conditions that create poverty.

A health program that attacks only one disease in isolation from social conditions may just trade one disease for another as the final cause of death. For example, the eradication of smallpox was estimated to add only between .09 to .81 years to life expectancy in Brazil, Nigeria, and India.

International institutions now recognize the important links between development and health. "Health is dependent on social and economic development, and also contributes to it," as the 1978 UN conference on primary health care in Alma Ata, USSR put it in the declaration calling for "Health for all by 2000."

The executive director of the UN

Fund for Population Activities, Rafael M. Salas, has noted that population research is being approached differently now.

"The initial impulse (for the first International Conference on Population) in Bucharest was the high rates of population growth in many countries. So the concern was mostly for high fertility rates. As a consequence of more thorough studies, it was found that the population concept has to be enlarged to accommodate other elements. Thus, you have this relationship with health, with family, with urbanization, with migration and other such factors."

Cultural and social habits are important to controlling a disease. For instance the spread of an airborne virus such as influenza cannot be limited by controlling the environment. The most common method of controlling a disease is to isolate people spreading the virus. But without compliance to a medical program because of overcrowding or poor ventilation, this control cannot be exercised.

Much of the previous demographic research of mortality in developing countries has been concentrated on the measurement of the level of mortality, according to Mark Farren, coordinator of the IDRC project on methodological research on population, health and development.

"Relatively little research has addressed the question of why mortality differs between urban and rural populations or according to different socioeconomic levels."

There is the lack of an adequate conceptual framework within which to design mortality and health research, said Mr Farren.

"Demographers are coming to appreciate that studying only mortality is akin to studying only the tip of an iceberg. The invisible and more voluminous portion of this iceberg is the poor and deteriorating health conditions of mothers and children."

IDRC has thus embarked on a 2-year project aimed at strengthening the research capacity of researchers in developing countries to help overcome the previously fragmented nature of research in this area by encouraging links between disciplines. IDRC is also supporting research focused on the development and testing of appropriate health technologies and the measurement of mortality levels in a number of different countries.

"We are getting away from a very simplistic approach to what improves the chance of a child surviving," said Mark Farren. "But information is far from comprehensive. Techniques have to be developed to assess the major factors and how all these factors work together."

Steve Hunt is an independent writer/broadcaster based in Ottawa.

NUTRITION AND RESEARCH

PER PINSTRUP-ANDERSON

International agricultural research has facilitated rapid expansion in food production and productivity in many developing countries. Despite the doubts of some, it is now documented that urban as well as rural poor would have been considerably worse off without the "green revolution." This type of research cannot substitute for other policies to improve the lot of the poor, such as increasing rural income and providing more abundant and less expensive food. Without other essential elements, including appropriate government policies, many of the poor may be bypassed, and some may be worse off as a consequence of the changes brought about through agricultural research.

Studies of the equity effects of the "green revolution" show clearly that the extent to which poor people gain or lose from the introduction of new agricultural technology is affected significantly by the present distribution of ownership of productive resources, access to modern inputs, the structure of the market, and the presence or absence of various related policies along with commodity priorities in research strategies. Thus,

although agricultural production research cannot eliminate skewed distribution of income and associated poverty and malnutrition, its effects on the poor and their nutritional status can be highly significant. So, nutrition implications must be explicitly considered in decision-making on agricultural research to enhance the positive effects and to avoid the negative ones.

Agricultural research and related policies offer great opportunities for long-term nutritional improvements, which will reduce or eliminate the need for direct nutrition intervention programs.

To realize these opportunities fully, nutritional issues must be explicitly considered when agricultural research is planned and due consideration must be given to potential nutrition effects of alternative research priorities and technology characteristics.

THE LINKAGES

Agricultural production research influences human nutrition through its effects on household incomes, food prices, agricultural production, nutritional composition of food, distribution of

income and time, demand for labour, and infectious diseases.

The primary reasons for calorie-protein deficiencies are likely to be low household incomes, insufficient food, and high food prices. Changes in any of these three factors are likely to influence food consumption. Changes in food supplies affect the nutritional status only to the extent that the food consumption of malnourished or at-risk individuals is affected. The degree to which expanded food production is translated into expanded food consumption by the malnourished varies depending on the crop or livestock species of which production is expanded, the nature of the technology that brings about the expansion, and who produces the increase. Thus, using total production expansion as a proxy for nutritional effect is likely to be misleading.

INCOMES AND FOOD PRICES

Changes in the incomes of households in which some members are malnourished and in the food prices that these households face influence their ability to obtain food, and their cost of food in relation to other household items.

Food consumption by the poor — particularly the urban poor and those rural poor who do not produce part or all of the food they consume — is highly sensitive to changes in prices of individual food commodities, since they are much more harmful to the poor than to the better-off consumers. Low price levels may, however, harm the nutrition of the rural poor who depend on food production for their incomes, and discourage food production.

Agricultural research may facilitate a reduction in the unit cost of production, thus generating an economic surplus that can be captured or shared by the producer, landless labourer, or the consumer as lower food prices. Decisions about commodity priorities in research and about

technology characteristics as well as about policies are likely to influence the distribution of benefits, and thus human nutrition.

Much malnutrition is found among semisubsistence farm households that produce most or all of the food they consume. The amount, kind, and availability of food during the year may be much more important than changes in food prices. Agricultural research may change the crop mix and the cropping patterns to feed the semisubsistence farm families better, but it may also harm their nutritional situation by encouraging monocropping of cash crops with its increased risks to farmers and increased prices to consumers. The farm households' additional incomes may fully compensate for the loss in consumption of their own produce by allowing them to buy more food, but other factors may produce a nutritional effect smaller than expected.

Calorie-protein deficiencies, particularly among the rural poor, often are a result of fluctuations — both seasonal and irregular — in food prices, incomes of the malnourished, and the availability of food.

Agricultural research may contribute to this problem or it may alleviate it by improving production or storage systems or making available improved crop varieties, such as those that permit a more appropriate crop rotation, are pest- and disease-resistant, and provide more stable yields under difficult and variable climatic regimes.

Agricultural research may also influence human nutrition through improvements in the nutrient composition of a particular crop, such as improvements in the protein quality of maize and sorghum. In the past, the nutritional implications of agricultural research were frequently assessed on the basis of the extent to which the nutritional composition of a given food was improved as if that food did not enter into a multiple-commodity diet. What is important is not

whether greater intake of nutrients by the malnourished is a result of the improved nutrient composition of a particular food, more nutrients from a larger quantity, or a more appropriate dietary mix of various foods. What counts is greater intakes from the diet as a whole.

INCORPORATING NUTRITIONAL GOALS INTO AGRICULTURAL RESEARCH

In view of these linkages between agricultural research and human nutrition, what can international agricultural research centres do to assure that nutritional goals are considered along with other goals in the planning of their programs and other activities? Nutritional concerns might be incorporated into four areas of decision-making: establishment of commodity priorities, specification of desired changes in the characteristics of certain commodities, specification of desired technology characteristics, and choice of production systems to be researched.

The key issue in commodity priority research is the change in total calorie and nutrient intakes by the malnourished that would come about as a consequence of the introduction of yield-expanding or yield-stabilizing technology for particular crops or species of livestock. This would be determined primarily by the relative importance of the crop or livestock species in the total diet of the malnourished and their reaction to changes in the price of the commodity, the extent to which farm households with malnourished members produced the crop or livestock species, the extent to which additional employment was created, and existing price and trade policies.

If malnutrition is found primarily among non-farming urban and rural consumers, research emphasis should be placed on the main foods they eat and for which

price reductions would lead to increased consumption of the particular commodity or to substitutions that would increase their total intakes of calories or of the nutrients they lack.

If, on the other hand, nutritional deficiencies are primarily found among low-income agricultural producers, research emphasis should be placed on commodities that would generate more income for these households, reduce risks and seasonal fluctuations, or make more food available to them from their own production. Priorities among commodities in international agricultural research cannot usually be limited to one or the other. Ideally, from a nutritional point of view, emphasis would be on commodities that occupy a large share of the budgets of households with malnourished members and for which reductions in prices would bring about a large increase in total intakes of calories and protein by those households, that occupy a large share of the resources of farm households with malnourished members, and that generate employment and incomes for the landless poor.

The important question concerning nutrition is whether total intake by an individual is sufficient and not whether any particular nutrient originates from one food or from another. In most instances, foods now being consumed by the malnourished are capable of providing an adequate diet if consumed in sufficient quantities and appropriate combinations. Potential nutritional gains from the improvement of traditional foods should not be ignored in agricultural research, however, since a modest research input can improve such things as protein content, cooking quality, digestibility, colour, oil content, and digestibility of available nutrients without unacceptable reductions in the achievement of other goals such as better yields and greater yield stability.

TECHNOLOGY CHARACTERISTICS

Research decisions determine or influence the nature of the resultant agricultural technology, which in turn influences human nutrition by determining how much more is produced of a particular commodity and at what cost, and by controlling the extent to which rural

The effects of changes in existing systems on the ability of the household to meet its nutritional requirements from its own production should be assessed. The focus should be on an appropriate mix of cash and subsistence crops to meet nutritional needs, while general expansions in real household incomes are sought. Local marketing



More food in the marketplace, but will the poor be better fed?

households with malnourished members gain from new technology.

The most important issues appear to be whether the low-income farm household is able to capture the benefits from new technology only if women allocate more time to the crop, whether these women are willing and able to allocate additional time, and what the nutrition implications are of such changes.

The effect of technological change on the distribution of control of the household budget between men and women and the resultant effects on food consumption and nutrition is another important issue that deserves additional attention from the research community.

PRODUCTION SYSTEMS

From a nutritional perspective, the key issue for research on production systems is how existing systems can be changed so that malnourished members of farm and rural labour households can increase their intakes of dietary elements such as calories, protein, and vitamins during critical periods whether from household production or from purchase.

inefficiencies, the inability of the household to deal effectively with rapid transition from a semi-subsistence economy to a cash economy, and related factors may render traditional economic criteria ineffective in assuring nutritionally appropriate changes in existing production systems. The question is not whether but how rural transformation should be promoted. Arguments that rural transformation based on technological change is generally disadvantageous to the rural poor conflicts with the empirical evidence. A great deal can be done to avoid hardships on the poor and to enhance positive effects. Agricultural research can do some, public policies and institutional changes must do most.

Per Pinstrup-Andersen is director of the food and nutrition policy program of the International Food Policy Research Institute (IFPRI), Washington. This commentary is an edited version of chapter three of International Agricultural Research and Human Nutrition (Washington, D.C., IFPRI, 1984). Reprinted with permission. For information: IFPRI, 1776 Massachusetts Ave, NW, Washington, D.C. 20036, U.S.A.

In the name of progress: the underside of foreign aid

Patricia Adams and Larry Solomon
Doubleday/Energy Probe
1985

(Energy Probe,
100 College Street,
Toronto, Canada
M5G 1L5)
229 pp., \$12.95

In the name of progress is a double-barrelled blast at the foreign aid establishment, claiming that development assistance more often than not results in the financing of undemocratic national governments against local populations in "a latter day moral equivalent of the slave trade."

The authors are staff researchers at Energy Probe, a Canadian environmental non-governmental organization that in recent years has become increasingly concerned about international development issues. The global nature of many environmental issues and the "everything is connected" perspective have naturally led the environmental movement in this direction. A variety of ecological critiques of development from both the South and North are emerging, including this

most recent Canadian effort.

Writing in a polemical style, Adams and Solomon rely heavily on examples of hydro megaprojects to debunk a series of "myths" about population and resources, Third World needs and foreign aid.

The argument starts off something like this: Internationally financed hydro megaprojects have displaced indigenous populations from their homelands, their means of subsistence, and their cultural identities, thus violating several articles of the International Bill of Human Rights. Many of the dam reservoirs are filling with silt that reduces generation capacity, shortens the productive life, and contributes to overall degradation of river valley ecosystems. The dams do not do much for the poor. The principal beneficiaries are the corporate interests in the donor and recipient countries who control and profit from the hideously corrupt and economically unsound practice of tying aid.

So much for the first four myths: that foreign aid is humanitarian, that it helps the Third World's poor, that hydroelectricity is renewable, and that tied aid is a good way to boost one's own economy while helping the needy abroad. The authors go on to set up and then demolish twelve other "myths" about energy, resources, and technology in developing countries.

Adams and Solomon conclude: "The problem with energy aid stems from the absence of an accountable and democratic process — an absence that starts in the Western donor countries and carries right through

to the Third World recipients. This absence is not limited to energy projects, but occurs across the board. Foreign aid may not be salvageable, but if it is, we believe that a fundamental change in the process that governs it is a prerequisite."

In addition to calling for national inquiries into the merits of foreign aid, Adams and Solomon recommend several other immediate measures for countering the absence of democracy in the foreign aid system. These include untying aid; increasing the role for privately funded charitable groups aiding the Third World; the adoption of neutral policies regarding technologies the West should promote to the Third World; and the refusal of funding to any government, company or project that violates the International Bill of Human Rights. Elaborating on this last recommendation, the authors recommend that funding be refused to any project that is officially opposed by an indigenous group in accordance with its own governing processes, to any project that has any adverse impact on local populations unless the affected groups consent through internally supervised negotiations, and to any project that requires people to be relocated without their consent.

In the name of progress is a controversial book, as it was no doubt intended to be. The Canadian International Development Agency (CIDA) comes under heavy fire in the book, and its president, Margaret Catley-Carlson, has publicly debated the authors. Energy Probe is an effective advocacy organization, and they will be lobbying for the adop-

tion of the recommendations in this book. That makes it must reading for all those concerned with Canadian's foreign aid policy.

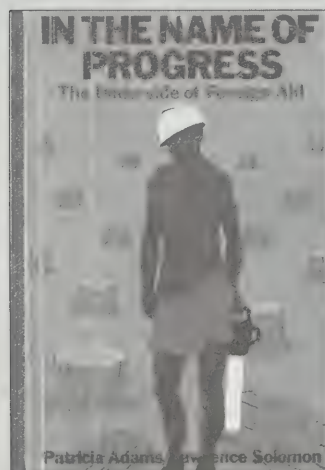
Ralph Torrie
assistant coordinator
Energy Research Group
an IDRC/United Nations
University project

Leucaena update

The tropical legume *Leucaena leucocephala*, or leucaena for short, is a fast-growing tree with tremendous potential in agroforestry, reforestation, and animal feed systems in the developing countries. (See "Leucaena: delivering the promise," *Reports* 12(4) January 1984.) But despite the fact that its protein-rich leaves are immensely palatable to cattle and goats, its use as forage has so far been limited by the presence of a toxic amino acid called mimosine.

Ruminants can tolerate a certain amount of mimosine in their diet because of their ability to break it down into the less toxic compound, 3, hydroxy-4(IH)-pyridone (3,4 DHP). But if the leucaena content of their diet exceeds 30 percent, DHP interferes with the thyroid's ability to incorporate iodine and they develop goitre, with listlessness, loss of appetite, and accompanying loss of weight.

Researchers in Ciawi, Indonesia, discovered that some goats and cattle can completely degrade DHP when goats on the animal research station acquired the ability from local livestock, possibly by way of saliva left on shared feed. Meanwhile, conflicting reports on leucaena toxicity from Hawaii and other areas prompted Dr



Raymond Jones of the Commonwealth Scientific and Industrial Research Organization (CSIRO), working with J. Brian Lowry of Indonesia, to test the hypothesis that leucaena toxicity in Australia was caused by the absence of DHP degrading bacteria. They successfully transferred the ability to degrade DHP from Indonesian goats to Australian goats fed on a sole diet of leucaena.

Subsequent work by Dr Jones and Mr Rob Megaritty (CSIRO Australia) and Dr Milton Allison (USDA Ames, Iowa) has shown that the bacteria involved in the degradation can be cultured in vitro.

Since then, rumen fluid from a Hawaiian goat has been used to provide inoculum for in vitro degradation studies with DHP and has been permitted by quarantine authorities for use in Australia. In one leucaena-grazing experiment, 20 cattle infused with the bacterial culture virtually ceased excreting DHP in their urine and their serum levels of thyroxine levels remained normal. In contrast, 20 heifers acting as controls excreted DHP in their urine and had extremely low levels of thyroxine in the blood. In another study, a steer infused with the Hawaiian culture medium and four control steers were grazed on a leucaena-based pasture and monitored for weight change, urinary DHP concentration, and in vitro breakdown of DHP. Within five weeks, it was evident that the ability to break down DHP had been transferred to the control animals: none were excreting DHP in their urine, all were able to break down DHP under laboratory conditions, and all showed good weight gain.

Preliminary evidence indicates that detoxifying bacteria become established in the infused animals. The initial animals have retained the bacteria for over a year now, giving reason to believe that a practical solution to the leucaena toxicity problem is in sight.

Hope Cadieux-Ledoux

Depo-Provera not approved

Depo-Provera should not be approved for contraceptive use in the U.S.A., a public board of inquiry in that country has recommended. The outside board was appointed in 1982 by the U.S. Food and Drug Administration (FDA) to review the status of the controversial drug, and its decision has been long awaited. The point of contention regarding Depo-Provera, an injectable long-lasting progestin, has been whether it will cause cancer in its users. Tests performed by the Upjohn Company, the manufacturers of the drug, have shown Depo to induce cancer in laboratory dogs and monkeys. Upjohn maintains that the tests are not conclusive for human beings. The board of inquiry, however, decided that the test findings cannot be dismissed as irrelevant to human beings without contrary evidence, which it says does not exist.

Upjohn says it plans to "take issue with" the board's report. It estimates that 5 to 9 percent of women in the U.S.A. would use the drug if it were approved by the FDA. The main attraction of Depo-Provera is its ease of use. A woman injected once every three or six months is protected from pregnancy with an efficacy rate comparable to the pill.

Unlike most drugs under FDA scrutiny, Depo has been used by millions of women in some 80 countries worldwide since 1967. The results of its use appear to be favourable, though usage studies have been few. Increased evidence of cancer was not, however, found in the few studies among women that were conducted. Depo has been endorsed by several prominent organizations, including the World Health Organization, the International Planned Parenthood Federation's Medical Advisory Panel, and the American College of Obstetricians and Gynecologists.

Though its cancer risk is not known, Depo-Provera's side effects are.

For many women, it disrupts menstruation, causing bleeding and spotting. It can also bring on amenorrhea (no menstruation), which continues as long as the drug is used. Side effects also include weight gain, possibly the raising of blood glucose levels, and sometimes dizziness and nausea. The widely used pill has side effects as well, including an increased risk of circulatory disease (especially for smokers), headaches, and heightened blood pressure.

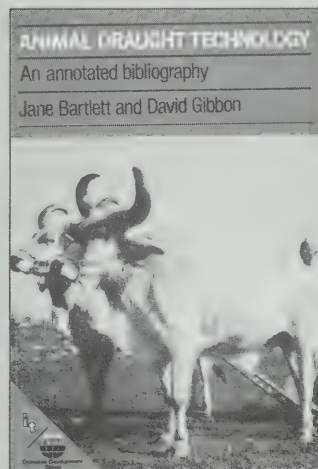
*Population Today
Population Reference
Bureau, Inc.*

Animal draught: book review

Jane Bartlett and David Gibbon. *Animal draught technology: An annotated bibliography*. The Development Group of the University of East Anglia in association with Intermediate Technology Publications, London, 1984. (IT Publications Ltd., 9 King Street, London WC2E 8HN, U.K.).

This small bibliography contributes to one of the most pressing issues of our time — the development of appropriate technologies for increased food production and improved standards of living for rural people in the developing world.

The bibliography concentrates on one particular technology — animal draught (often called animal traction) — which is important to the farming systems of many developing countries, and appears to have a considerable potential, particularly in Africa. The



authors suggest that the introduction of tractors into small farms in many developing countries has often been unproductive, and has sometimes led to the displacement of labour and the increase of larger farms at the expense of small farms. They conclude that:

"It is now generally accepted that much of the technology that has been imported into developing countries is too complex ... Initial cost is frequently high and there is a high dependence on a continuing supply of external inputs."

It is becoming increasingly clear that although some simple improvements of farming in the developing countries can often be made, further improvements in these systems usually require a concentrated research effort at the farm level, supported by strong backup research, combined with appropriate policy decisions and changes in infrastructure, inputs, markets and prices. Animal draught is just one component of the package.

On the whole, however, this bibliography should provide an invaluable source of reference material for those working on research, extension, and development programs involving animal draught.

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Appropriate technology microfiche reference library

An 872-volume reference library that can be easily carried by hand is an apt description of a microfiche library of books and documents dealing with appropriate technology in the Third World, put out by an American appropriate technology group.

As produced by the Appropriate Technology Project (ATP), the microfiche library weighs only 10 kilograms (23 pounds), including the viewer. The library takes up a drawer and desktop, instead of a room, and

costs US\$875 with microfiche viewer, instead of an estimated US\$12 000 for "hard copies." Included in the microfiche library are 750 publications reviewed in the *Appropriate technology sourcebook* and over 100 new titles, such as IDRC's *Rural water supply in China* and the best new books from Oxfam and Unicef.

Reviews of every publication, along with a 5000-entry index are provided in the index and supplementary reviews. Since the books are already catalogued and indexed, ATP claims they are easy to use and that the reviews give the reader a good summary of reference books on all the major village technology topics.

The library comes ready to use, saving the many hours of staff time that would be normally needed to locate, assemble, and catalogue a collection of this many books. The 1500 microfiche cards (11 cm x 16 cm) hold either 98 or 133 pages of text, which is magnified to its original size on a special reader. The sheets of film are not affected by humidity and fungus, and will withstand 10-20 years of heavy use, according to ATP.

For information: The Appropriate Technology Project, Volunteers in Asia, P.O. Box 4543, Stanford, California 94305, U.S.A.

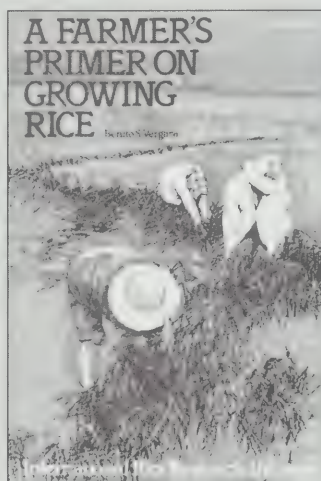
A farmer's primer on growing rice

Possibly the most widely translated agricultural book in the world is a rice-growing manual written by a scientist at the International Rice Research Institute (IRRI) in the Philippines. "A farmer's primer on growing rice" has been published in 22 languages in Asia, Africa, and Latin America. Editions in at least 13 other languages are in press or being translated.

The author, IRRI plant

physiologist Dr Benito S. Vergara, became aware of the lack of a simple text explaining good rice-growing practices when he was teaching an IRRI course on rice cultivation. He felt that farmers should understand the reasons for the recommended cultivation practices, not just the steps for successful rice cultivation, already explained in various leaflets.

IRRI trainees who had used earlier versions of the primer wanted it to be available in their local languages. Even before it was printed in English in



1979, requests were made to permit translations into Thai and Bahasa Indonesia.

Today, the primer is available in many of the languages used in rice-growing countries: Urdu in Pakistan, Tagalog in the Philippines, Spanish in Mexico, Sinhalese and Tamil in Sri Lanka, and Swahili in Tanzania. In all, the primer has been translated into 22 different languages.

Black and white illustrations, with few words, convey the techniques of rice culture in "A farmer's primer," making it easier to understand and to translate. IRRI provides, without fees or royalties, sets of illustrations with the English text blocked off to facilitate its printing by Third World agricultural agencies.

Vergara is modest about the success of his book. He is now working on new sections for a revised edition. The new primer will address problems such as low soil nitrogen; rice cultivation for cold, hilly areas; and the selection of rice varieties for specific environments.

Specific language copies of the primer are available from the Communications and Publications Department, IRRI, P.O. Box 933, Manila, Philippines.

The missing link: information for research on diarrhoeal disease

By and large, scientific researchers based in developed countries can take for granted ready access to vast, well-managed information resources: among them, well-stocked libraries, offering a veritable abundance of research materials, and classified to a superb degree of scientific sophistication.

By contrast, developing world researchers are seldom supported by such information, for good research libraries are far beyond the financial means of most poor countries, and are often not perceived as one of the necessary scientific tools.

One area of research where this information gap yawns particularly wide is diarrhoeal diseases research. Yet it is a critical field for developing nations: diarrhoeal diseases (typhoid, cholera, dysentery, shigella, etc.) are the first or second greatest cause of deaths in most developing countries (vying with pneumonia and other acute respiratory infections) in the toll they exact.

Seeking to alleviate this problem, IDRC has been financing, for an initial three years, a clearinghouse solely devoted to acquiring and disseminating information on diarrhoeal diseases, particularly for and by

Asians. DISC, the International Diarrhoeal Disease Information Service and Documentation Centre, has as its principle aims the increased flow of information, so helping to avoid unnecessary research duplication.

DISC was established in 1982 at the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) — the sole international institution dedicated only to studying the causes, preventives, treatments, and cures for the diarrhoeas.

DISC Project Director is Dr K.M.S. Aziz, the ICDDR,B's Associate Director for Training, Extension and Communications. To Dr Aziz, DISC is a critical innovation: "Most developing nation libraries are highly inadequate. Moreover, for the most part, Asians must depend on Western research literature, because they don't have access to their own, for two main reasons. First, only about 35 percent of existing Asian diarrhoeal diseases literature is indexed internationally. Second, for diverse reasons, Asian scientists do not have adequate opportunities to publish results of their research in internationally reputed journals," says Dr Aziz.

DISC is a multipronged effort — in which pertinent published and unpublished Asian research papers are collected, organized, analyzed, indexed, and the resulting information is disseminated around the world. Noteworthy research papers are abstracted or summarized; scientists' research views and interests are solicited. A question-and-answer service is also provided. For information: DISC/ICDDR,B, G.P.O. Box 128, Dhaka-2, Bangladesh.

Naomi Rock Novak
Communications
Coordinator
ICDDR,B.



A success story in health education

IDRC's Communications Division began planning the film *Prescription for health* at the beginning of the UN Decade for Drinking Water and Sanitation. The Health Sciences Division recognized that there was a gap in all the information and publicity generated for and about the Decade. IDRC wanted to make a film that would underline the reality that any technical solutions to the delivery of water supply and sanitation in the Third World will come to nothing... unless they are coupled with measures that will break the fecal-oral transmission route of diarrhoeal diseases. The film idea enjoyed support from the World Health Organization and Oxfam as well, for the same reasons.

Often health education

films are country-specific, with a particular local "character." By using animated characters interspersed with "global village" scenes, taken mainly in Asia, *Prescription for health* has a more universal appeal and usefulness. Hundreds of copies in English and French have been distributed and sold throughout the world. IDRC has encouraged production of numerous language versions by agencies that have broadly based health programs in developing countries. Unicef is one of the best customers for the film; the organization has purchased about 100 copies for use in Asia and Africa. Unicef offices in Pakistan, India, Bangladesh, Burma, and Sri Lanka are producing local-language versions.

The Malaysian Medical Association is completing Malay and Tamil versions with funding from the Canadian High Commission. In the Philippines, Kabalikat ng Pamilyang Pilipino, a local non-governmental organization, has produced a Tagalog version on video, and in Thailand the Population and Community Development Association has completed a Thai version on video. Other agencies are also involved. CARE is producing an Indonesian version and

the Pan American Health Organization is beginning work on a Spanish version. Nepali, Mandarin, Arabic, Kiswahili and Shona versions, as well as productions in South Pacific languages are being discussed with various organizations.

Surprisingly, some agencies have found use for the film in countries with very different cultures and terrains from the Asian countries for which the film was primarily designed. In Senegal and the Central African Republic, separate audio tapes have been produced in local languages to accompany silent projections of the French version.

Although the target audience for the film is health workers and sanitary technicians, some agencies have found it useful as an educational aid for village health meetings. There is evidence that the film's animated sequences can be understood by audiences with widely different educational and cultural backgrounds.

Support materials are presently being developed to accompany the film and to act as a guide for the production of special support materials for specific countries. It is felt that the film will be even more useful once these

materials are ready.

Prescription for Health has struck a chord of need around the world for this kind of visual information, resulting in a distribution program of unique breadth and depth.

- "The film's message is very clear... It puts across the connection (between faeces and diarrhoeal diseases) in a very clear and understandable way." Andreas Fugelsang, Dag Hammersjold Foundation, Sweden.

- "Excellent film." John Austin, USAID.

- "We think it is an excellent film. It deals with a difficult subject in a highly professional way. The animation gets the point across well and can even be described as 'entertaining.' World Bank.

- "An excellent teaching aid in promoting safe water and sanitation in our project areas." Unicef, Sri Lanka.

- "Very clear, very carefully done. I enjoyed the way you kept the location as a 'universal village.' Worldview International Foundation, Sri Lanka.

In addition to IDRC *Reports*, the Centre publishes a wide range of material on development issues. These include scientific monographs, reports, and bibliographies on specific IDRC research areas, as well as general interest literature. These publications represent research interests and activities supported by IDRC in agriculture, food and nutrition, population, health, education, information, and social sciences. Films describing the Centre and some of the areas of development research are also available. A catalogue of current material, publications or films, is available from the nearest IDRC regional office or from IDRC in Ottawa (see page 3 for complete addresses).

Publications may be ordered from the IDRC sales agents listed here.

AFRICA

The Textbook Centre
P.O. Box 47540
Nairobi, Kenya

Tanzania Publishing House
47 Samora Avenue
P.O. Box 2138
Dar-es-Salaam, Tanzania

ASIA

Select Books Pte. Ltd
19 Tanglin Road No. 03-15
Tanglin Shopping Centre
Singapore 1024
Republic of Singapore

Oxford Book & Stationery Co.
Oxford Building
N 56 Connaught Circus
New Delhi 110001, India

University of Malaya
Cooperative Bookshop Ltd
P.O. Box 1127 Jalan Pantai Baru
Kuala Lumpur, Malaysia

Suksit Siam
1715 Rama IV Road
Bangkok, Thailand

CANADA

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Ottawa, Ontario, Canada K1P 5A5

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Intermediate Technology
Publications Ltd
9 King Street
London WC2E 8HN, England

USA

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Murray Hill Station
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reports

THE
IDRC

**SPECIAL
ISSUE:**
**IDRC's
15TH
ANNIVERSARY**



LETTERS

URBAN STUDIES

I am writing to you as the editor of the *Urban Edge*, a World Bank publication on urban development, which I hope you receive regularly. Your Vol. 12, No. 4 issue of *IDRC Reports* was extremely well done and I wanted to follow up on several things that were discussed.

First, is there a list available of the urban-related research studies that you have sponsored or are currently supporting? I am interested in knowing about all of them, but I am especially interested in those involving indigenous specialists. Second, could you send me copies of the studies that you mentioned in your article on food distribution and markets in urban areas, on low-cost transportation, and on mechanisms to deliver basic urban services.

We would be pleased to review any new publications from IDRC in our regular resources column. So if you have a regular distribution list, please include us.

Thank you very much. Again, I thought the issue was a very fine one.

Jan Austin
Editor—Urban Edge
The World Bank
Washington D.C.
20433 USA

Almost all IDRC funded projects are run by indigenous specialists. IDRC will gladly supply scientists or institutions with details of projects or new publications that are of interest to them.

The Editors

TREES

I read with much interest your article "Trees Take to the Fields" in the April, 1985, issue of *IDRC Reports*. Could you please give me the addresses of Christine Okali and James Sumberg, so that I can learn more about the project? It would be interesting to conduct field research on alley cropping.

Lawrence S. Grossman
Associate Professor
College of Arts and Sciences
Virginia Polytechnic Institute
and State University
Blacksburg, Virginia 24061

You can contact the scientists in charge of this alley cropping project through ILCA c/o IITA, PMB 5320, Oyo Road, Ibadan, Nigeria.

The Editors

ALLEY CROPPING

Your article on alley cropping in Nigeria (*Reports* 14(1) April) was very good and you are to be congratulated.

You might be interested to know I am sending out copies to various project leaders and other forest researchers in the EARO region. I also am developing the habit of leaving copies with people on my travels. Perhaps you may get some feedback.

Best regards.

Ron Ayling
Eastern and Southern African
Regional Office
IDRC
P.O. Box 62084
Nairobi, Kenya

MINIGENERATOR

In the *Medicine Digest* issue of April 1985 Vol. 11 No. 4 appeared information referring to an electric turbine "Village Hydroelectricity" that came out in the *IDRC Reports* of October 1984.

We would be grateful to have detailed information on this equipment and/or a copy of the relevant IDRC report.

We naturally undertake to reimburse you for any expenses incurred.

H. Steyn
Rift Valley Seed Ltd.
PO Box 44924, Nairobi
Kenya

The article "Village Electricity" was supplied to *Reports* by China Features Service, a regular contributor to the magazine. More details could be obtained by writing to Chen Lung, Director, China Features, P.O. Box 522, Beijing, China. China Features do not have identifying numbers, but if you describe the contents of the article and indicate the name of the author, Wu Chiang, they should be able to send more details about the minigenerator.

The Editors

A NEW READER

I borrowed a copy of your *IDRC Reports* from a friend and read and it was so educative. I would therefore be very grateful if you can enlist me as one of those to whom you would be sending the paper or send the necessary forms so that I fulfill the subscription formalities so as to receive it from time to time.

I would be grateful if my

application is kindly considered.

Thanks in advance.

Nebane Ngwa Loël
Divisional Inspectorate of
Labour and Social Insurance
Mbengwi, Momo Division
Northwest Province
Republic of Cameroon
West Africa

The *IDRC Reports* is available free of charge to researchers, educators and decision makers in developing countries. We ask people to fill out a short questionnaire to establish whether they are entitled to receive the magazine. Upon receipt of the completed application, we will be glad to add you to our mailing list.

The Editors

Editor's Notebook

After this issue, a new team will be in charge of the production of IDRC's magazines.

Gery Toomey will be the associate editor responsible for the English version, *The IDRC Reports*. Jacques Dupont remains as associate editor of the French magazine, *Le CRDI Explore*, while Stella de Feferbaum (at the IDRC office in Bogota) continues to ensure the quality of the Spanish version, *El CIID Informa*. Jean-Marc Fleury, former regional liaison officer in Dakar, will be the new editor-in-chief.

Furthermore, the editors wish to acknowledge the contribution of Anne Fisher who has been indispensable in the production of this special issue.

Finally, the whole group wishes success to Rowan Shirkie, the former editor-in-chief, who has left IDRC to pursue graduate studies in communications.

Reports

THE IDRC

The IDRC Reports and companion editions *Le CRDI Explore* and *El CIID Informa*, about the work of the International Development Research Centre and related activities in the field of international development, are published quarterly and are available on request from the Communications Division, IDRC, P.O. Box 8500, Ottawa, Canada K1G 3H9. *Editor-in-chief*: Rowan Shirkie. *Associate Editor*: Jacques Dupont. *Spanish edition*: Stella de Feterbaum. *Staff photographer*: Neill McKee

CONTENTS

Letters		2
The African queens	Ania Wasilewski and Anne Fisher report on the bounty of bees.	4
Extinction is forever	Little-known livestock breeds can make a major contribution to the world's animal gene pool. By David Creighton.	7
The un-cattle of Bali	Anne Fisher reports on research into the use of by-products to supplement the diet of Indonesia's Banteng cattle.	9
Strangers in their own land	Migration by the Baule people within Ivory Coast creates tensions. By Jacques Dupont.	10
Small is productive and nutritious	Small-scale food processors around the world get technical advice. By Bill Edwardson and Lorne Peterson.	12
Briefs	News and trends in development.	14
SPECIAL SUPPLEMENT		
IDRC celebrates its 15th anniversary with a look to the future and a sample of past progress.		
For the benefit of people	IDRC President Ivan L. Head explains the Centre's innovative approach. After 15 years the excitement is still there.	15
The changed context	Francisco Sagasti traces the increasingly complex relationships between science and technology, international development, and the world economy.	17
Famille et Développement	The story of a magazine that candidly discusses the changing way of life in Africa. By Jean-Marc Fleury.	20
The PVC pump branches out	IDRC's handpump is changing as it travels through Africa and Asia. Reports from Don Sharp and Mallika Wanagasundara.	22

Aquaculture	Raising fish in village ponds. Sino-Canadian fish-breeding research. Articles by Andrew Williams and Zhang Weimin.	26
Beyond basic literacy	A look at a rural university in Colombia. By Gerry Toomey.	30
Insider/outsider	Farzam Arbab asks: Development for whom?	31
What is IDRC?	Who we are, what we do, and why we do it.	33
Sweet potatoes go commercial	Paul Icamina tells how the Philippines' crop of last resort becomes a commercial success. In a separate article he profiles the man behind the sweet potato.	35
The ills of urbanization	Low-budget schemes aim to rescue India's cities. By André McNicoll.	39
Cookstoves	Rural people still prefer open fires but new stoves help city dwellers conserve fuel. Reports from Debora Cowley and Fibi Munene.	40
The cassette that talks back	Mario Kaplún finds a way for community-based co-ops to create a dialogue.	43
Professor Nayudamma	Joseph Hulse honours a former IDRC Governor who lost his life on Air India's flight 142.	45
New releases		46



Cover photo: A young Malaysian from Negri Sembilan draws precious drinking water using a plastic pump developed in her country. See articles beginning on page 22.

The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in five sectors: agriculture, food, and nutrition sciences; health sciences; information sciences; social sciences; and communications. IDRC is financed solely by the Parliament of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are located at 60 Queen Street, Ottawa, Canada (P.O. Box 8500, Ottawa, Canada K1G 3H9). Regional offices are located in East Africa (P.O. Box 62084, Nairobi, Kenya); West Africa (B.P. 11007, C.D. Annexe, Dakar, Sénégal); Asia (Tanglin P.O. Box 101, Singapore 9124, Republic of Singapore); South Asia (11 Jorbagh, New Delhi 110003, India); Latin America (Apartado Aéreo 53016, Bogota D.E., Colombia); and the Middle East (P.O. Box 14 Orman, Giza, Cairo, Egypt).

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Unsolicited manuscripts and other editorial materials are welcomed and will be considered for publication.

All photos IDRC unless otherwise specified.

THE AFRICAN QUEENS

ANNE FISHER

African bees were imported into Southern Brazil in 1956 by a Brazilian geneticist as part of a bee keeping experiment. The researcher hoped to boost honey yields by developing a honeybee better suited to the tropics than the European bees. There are no honeybees indigenous to the Americas, and although the introduced European bees had flourished in the temperate areas, they had not done as

well in regions with tropical climates. In 1957, before the experiment was completed, 26 queen bees plus a number of drones escaped to conquer South America, make newspaper headlines and even inspire a horror film entitled "The Swarm".

Although the Africanized bees are unlikely to sting when foraging, die once they have stung, and have a sting no worse than a European bee's, many animals and even some people have been killed when attacked by Africanized bees. When the colony is disturbed, the bees are defensive. They will emerge from the hive or nest in great numbers, attack viciously and follow the disturbing person or animal much farther than European bees would.

The very attributes that apiarists hoped would improve the European bees made the African bees very successful in Brazil. The bees are excellent foragers, nest almost anywhere, are fiercely aggressive in defense of their colonies, and spread by forming new colonies very rapidly. But these bees, which have almost replaced the European varieties in Brazil and other South American countries, require special management techniques.

"More than anything else," said Dr Willard Robinson, who worked with the same *Apis mellifera scutellata* in Kenya, "it is the fierce nature of the African bee that dictates schemes for its management."

The bees were so unsuited to the conventional beekeeping techniques geared to the European bees that they wreaked havoc on the beekeeping industry in Brazil. Before the arrival of the bees, the country's honey production was some 5000 tons per year. Beekeepers were so discouraged by the effect of the Africanized bees that an estimated 30 percent of the commercial, and 80 percent of the small-scale apiarists, gave up beekeeping.

With changes in the management practices and government encouragement, honey production is now back on stream in Brazil and the total yield has actually increased in the last 15 years.

The Africanized bees, now dubbed "killer" bees, reached Colombia in 1978. IDRC decided to help fund research there to help the beekeeping industry cope with the influx of the new bees. Dr Adolfo Molina, an entomology professor at the University of Colombia in Medellin, who had previously studied the beekeeping methods used with these bees in Kenya, heads the project. He is not only hoping to minimize the negative impact of the



Apis mellifera scutellata: Killer bee or economic resource?

African bees, but to look for ways to use them to their best advantage. Although the bees are harder to handle in some ways than their gentle European relatives, he feels that the less intensive and less complicated methods that work best with the Africanized bees would provide an excellent opportunity to promote small-scale apiaries among Colombian farmers.

Although they spread across North America very

quickly, the European bees have never adjusted well enough to the tropics to go wild there. But the Africanized bees frequently form new colonies by swarming, and nest almost anywhere, making it easy for peasant farmers to pick up a few colonies for nothing, and start an apiary.

This swarming behavior combines with a tendency to abandon the hive (abscond or migrate), leaving them empty. If a third or more of one's hives are likely to be empty at any one time (as has been the case in Kenya), the hives must be cheap enough to pay for themselves during the time they are full. If expensive Langstroth (the standard commercial) hives are used, the beekeeper cannot afford to have empty hives. But if simpler, homemade hives such as the Kenya Top Bar Hives are used, the effect will be less devastating.

As part of the research project one Colombian student has joined the Master's program at the University of Guelph (in Canada) to study African bee management and appropriate technology for the design of hives.

In Colombia bee hives are traditionally kept in the farmyard, close to the house and other buildings. The aggressiveness of the Africanized bees makes this dangerous. Although small apiaries are both less likely to be deserted because of lack of forage, and less dangerous, even these will have to be kept farther from people and livestock. In theory, hives kept farther from the beekeeper's house may be inviting to thieves, but the ferocity of these bees may make their honey less tempting to robbers.

Commercial apiarists practice intensive management of their hives. They check hives frequently and supply new queens (usually purchased) annually. Peasant farmers in Colombia have rarely adopted these practices and so have been at a disadvantage when dealing with European bees. But many of the complex techniques are harder to practice with the Africanized bees so their presence should allow small-scale producers to be more competitive.

Although the accidental introduction of African bees to South America seemed at first to be a major disaster, it may yet, with proper management, prove to be a boon to the farmers of Colombia and other South American countries. □

Anne Fisher is a freelance science writer.



Dr Mohamad Bin Muid: Helping to build a subsistence industry and research base.

Sitas Sarto stands beside one of 35 square wooden boxes on his 1-acre coconut/cocoa plantation in Tanjung Karang, Western Malaysia and laughs. Within the past six months his newly established bee colonies have produced about 3 kilos of honey each and his income has increased by about 25 percent. His house has been improved with new wood planks and his children have new clothes.

The agricultural extension worker responsible for the area, Mohamed Tohid, stands beside Sarto, amazed. He cannot understand why Sarto's hives have been so successful and his own, only a few kilometres away have not. Dr Mohamad Bin Muid, IDRC project leader for the Malaysian beekeeping project, explains that it could be a combination of factors including the design of the hive, the number of hives in the area, and genetics — whether the local bees are naturally low or high honey producers.

Although honeybees are native to the Indo-Malayan region, only India and more recently Sri Lanka (with CIDA assistance) have modern beekeeping industries. The collection of honey from wild bees is traditional in Malaysia where colonies are found in coconut trunks, rafters of houses, rusted old tins in yards and sometimes even in outhouses.

HIVES IN COCONUT TRUNKS

The IDRC project began two years ago when Dr Makhdzir Mardan of the University Pertanian Malaysia (UPM) noticed that people in the Muar district had captured wild colonies of *Apis cerana* with their hands and were keeping hives in coconut trunks

THE TASTE OF COFFEE, COCONUT AND FRUIT

ANIA WASILEWSKI

"with no frames and with all the combs hanging down from the top piece". In modern beekeeping the honey comb is formed on a square wooden frame with two wires spread across to maximize honey production. The local people had been gathering the honey and earning some extra money by selling it. Demand for honey has always been high in Malaysia; in fact Malaysia has imported between 340 000 and 473 000 kilograms of honey per year for the last nine years and the amount is increasing. Most of the honey comes from Australia, China and California.

Mardan did some research and discovered that European bees had been imported several times to Malaysia in an effort to establish commercial beekeeping, but they had always died out. Mardan decided to concentrate on the local indi-

genous honeybee — *Apis cerana* — which unlike the giant honeybee — *Apis dorsata* — can be hived.

With IDRC's assistance, a four-year research and development program was begun, based at UPM, near Kuala Lumpur. The project is unusual in that it has successfully combined the development of beekeeping as a subsistence industry for small-holders of coconut plantations with the development of an apiculture research base by academics and scientists from various Malaysian institutions and is progressing simultaneously on both fronts.

The eight researchers are working in six different areas — bee management, bee botany, bee nutrition and honey analysis, pests and diseases of honeybees, research on *Apis dorsata* and the provision of practical information to small farmers. The project is also examining beekeeping in rubber plantations; Malaysia is the world's largest producer of rubber and of oil palm. However the nectar flows for only two months of the year in rubber areas so researchers are looking at migratory beekeeping, perhaps in rotation with rambutan, durian and other fruit crops. Very little is known about pests and diseases of bees under rubber — the problems are quite different from those in coconut areas.

BEE CALENDAR COMPLETED

Half-way into the project the researchers have completed a bee calendar detailing the activities of the *Apis cerana* throughout the year and thus establishing a procedure for bee management (when to feed the colony sugar-syrup because of reduced nectar flow during the dry season, at what

time of year swarming is likely to occur and how to avoid it, when to harvest and when to check for mites and pests), and are now developing a pollen atlas.

They have also designed a basic standard wooden beekeeper's box suitable for the humid Malaysian climate. Since March, Muid has been experimenting with supers, frames which are placed on top of the brood box and are filled only with honey, a more efficient and time-saving process for collecting and separating brood and honey. The problem is to determine when and if the bees will move up from the brood-frames to the super-frames, this being dependent on the available nectar and the number of frames.

The researchers are also developing stronger strains of bees by breeding and grafting queen-bees from stock which is highly productive. They are developing local quality standards for honey — in Malaysia darker, slightly fermented honey is more popular but after six months on the shelf it goes sour. So researchers are working on a thicker honey with less water content and less yeast.

QUEEN-GATE: A SIMPLE IDEA

The biggest pest problem faced by beekeepers is the wax-moth, but according to Muid, this is mainly a management problem. "We ask the farmers to check hives regularly and destroy combs with moths and bits and pieces of wax on the floor because this is where the wax-moth breeds." The queen-gate, a small piece of wire mesh, which is used to prevent the queen bee from absconding (leaving the hive for a new one and taking all the bees with her) also serves as an obstacle to keep wasps out. "It's a simple idea," said Muid, "but it was hard to come by." Until last year, 6 out of 16 colonies in one area were lost due to absconding, now with the use of the queen-gate, the rate is 0.

The queen-gate is one of several innovations the Malays have picked up from the Central Bee Research Institute in Pocina, India. In the past two years, six extension workers and laboratory assistants were sent to India for courses on queen-rearing and basic bee management. In Malaysia itself almost 200 farmers and extension workers have attended three- to four-day training sessions at UPM where they learned how to catch a wild colony, the different types of bees, the functions of workers, queens and drones, what equipment to use and how to make it, how to extract honey and month-by-month management of the hives.

Most of the farmers involved own small, one- to three-hectare coconut/cocoa or coconut/coffee plantations and have about a Grade 6 education. Muid is awed by "the ingenuity of the farmers — they use coconut husks or burning rope for smokers, and old nail boxes from China for hive boxes."

The farmers and extension workers come from all over Malaysia to attend the course, and when they return home they teach their neighbours what they learned. Sarto



An experimental beekeeping box for Malaysia's humid climate.

*Farmers' ingenuity:
"They use coconut
husks or burning rope
for smokers and
old nail boxes
from China
for hive boxes."*

became interested in beekeeping when he "saw Tohid building all sorts of boxes." He then captured 15 colonies and transferred them into hive boxes "not knowing which were worker bees or queen bees", or even if there was a queen for every hive.

Muid said, "The project is really mushrooming, at a rate I can only estimate, we can't keep records it's expanding so fast and we don't know how many benefit from the training." In the area we have just visited there are now 14 small-holders keeping bees, only five of whom were originally trained at UPM courses. But the enthusiasm of the farmers and their desire to participate has created certain problems. The demand for courses is much more than the project can handle and if the farmers do not receive adequate basic training in bee management or advice when pest problems, swarming and dearth periods arise, they will not succeed in producing honey.

"Often the enthusiasm of the farmer exceeds the advice of the extension officer and myself," said Muid. The farmers over-

stock the hives, use the supplementary diet continuously instead of only in the dearth periods and sometimes believe that frames are unnecessary. "But they're learning the hard way — through experience," said Muid. He tries to visit as many of the farmers as he can and dispenses queen-gates and advice but he said, "We can't keep up this momentum because there are only three people involved in follow-up work, only three who know what they're talking about."

BEE RESEARCH INSTITUTE NEEDED

"What we need is a centre for beekeeping, to get researchers such as botanists and food scientists, not university lecturers, but people who are free from other duties. Call it a beekeeping research institute on par with the Rubber Research Institute. I'm able to come out this week only because I'm not teaching. Now that people are actually earning money from this, perhaps we'll get more government support, more courses, more personnel."

An advanced training course is planned to enable 25 extension officers and farmers who have already taken the basic course to teach it to interested farmers. "My hope is that they have enough experience at this stage," said Muid, "so that they can take over this load." He added, "Later in July when we form the Beekeepers Association of Malaysia maybe we'll get a more accurate idea of how many people are involved in beekeeping."

Even enthusiasts like Muid predict that honey from *Apis cerana* will never completely replace imported honey. Malaysians prefer the local honey which sells for \$12 Malaysian "because it tastes like coconut and coffee and fruits" to Australian honey which sells for only \$3½ Malaysian but "tastes of eucalyptus trees." Honey from the *Apis cerana* is also widely believed to have medicinal qualities and, according to Muid, "never reaches the shelf because it is always reserved by customers beforehand."

IT'S LIKE FISHING

The farmers say that beekeeping, besides "moderately" increasing their income, is very satisfying. "It's like fishing," said Sarto. "You can relax and and observe them, even if you don't get any honey."

Muid said the more experience the farmers have the more successful they will be in producing honey but they must have the appropriate technical support. Most farmers have about three hives but want to have 30 if they can. The potential is there — abundant outlay, vigorous local participation and expanding academic research. Muid likes to repeat what Peter Kevan, an apiculturist from the University of Guelph, who visited last year, told him about the prospects for beekeeping in Malaysia: "It will soon go out of control like a forest fire!" □

Ania Wasilewski is a freelance writer. She visited IDRC's project while she was in Malaysia.

As a result of the overwhelming success of poultry and livestock breed improvement after the Second World War, the population of an odd and ancient short-legged breed of chicken, "Scott's Dumpy", had declined to the last 10 members of its race by 1976, or so Joe Henson of the Rare Breeds Survival Trust in England, ruefully surmised. To his astonishment, a woman in Zimbabwe who read of his concern in the newspaper, looked out her window onto the barnyard flock of 200 birds established by her grandfather some 50 years before, realized she was the custodian of a world treasure and wrote to Dr Henson. Subsequently the breed was re-established in England, where it will soon contribute significantly to the poultry industry. It seems that British hens lay standing up and many British egg producers have been suffering undue losses from cracking when the eggs are dropped unceremoniously on the cage floors. Recent trials have shown that a few "Scott's Dumpy" genes can shorten the layers' legs enough to significantly reduce these losses.

POTENTIAL GENETIC CONTRIBUTION

All over the world there are displaced or little-known domestic breeds whose continued survival is tenuous and whose potential genetic contribution to the world livestock pool is unexamined or unknown. At the same time, we are more dependent on fewer lines of fewer breeds of livestock than a generation ago, as a direct result of the success of highly developed breed selection techniques. The first stage in the selection process was domestication some 5-10 thousand years ago when "island populations" were first captured, isolated from their relatives so that genetic distance developed and the major livestock forms were established. The second phase, of modern breeding, began 200 years ago with Mendel's discovery of the mechanisms of inheritance, the breeding experiments of Blakewell and others and the founding of all the modern breeds in England and Europe. The third phase began in the 1930-40s when selection theory became well understood, systematic production and performance recording led to intensive inbreeding and culling, and artificial insemination and embryo transplant technologies limited male breeding stock to highly superior animals.

This breeding, combined with intensive feeding and highly developed management techniques, resulted in spectacular gains in productivity. For example, in 1950 chickens which had a feed conversion ratio of 4:1 (that is required four kilograms of feed to produce one kilogram of meat) had a feed conversion ratio of only 1.5:1 by 1980. Egg production showed similar gains. Dairy cows in Norway almost doubled their milk production from 2800 kg to 5200 kg in 23 years, mainly by replacing the numerous landraces with the superior Norwegian Red breed. In Canada, Holsteins now constitute 95 percent of the registered dairy population

EXTINCTION IS FOREVER

THE GENETIC IMPORTANCE OF ENDANGERED LIVESTOCK BREEDS

DAVID CREIGHTON



Bolivian llamas: A neglected species with genetic potential.

and these herds have increased their average annual milk production by 45 kg a year for the past 15 years. The developing countries were left out of this revolution.

Developing countries have the bulk of the world's livestock, two-thirds of all the cattle, 60 percent of the pigs, more than half of the sheep and 95 percent of the goats. Yet the industrialized countries produce 67 percent of the beef, 60 percent of the pork. An average Holstein cow produces four times as much milk as a tropical cow.

OBJECT LESSONS

It seemed an obvious idea to introduce these improved breeds into the tropics, so that the developing world could benefit from their increased productivity. However, the first experiments with importing temperate breeds into tropical countries were object lessons. As Charles Hickman, Ottawa-based world livestock authority, says, "There is no doubt that high production is itself a stressful factor and

particularly so in harsh environments." High production requires high metabolic activity which produces heat. In temperate climates, this metabolic heat can be more easily dissipated than is possible in hot and humid climates. When an animal fails to control its body temperature under the stress of a hot climate, high feed intake, close quarters and high production, its vital functions begin to fail. Tissue damage aggravates the situation, causing additional metabolic heat production. "Lack of coordination and disability follow, causing a climatic prostration and death in otherwise healthy animals."

Furthermore, the tropics are not the only inhospitable environments where mainstream agro-industry breeds are at a disadvantage. The alpacas and llamas in the Andean highlands, yaks in the Himalayas or water buffalo, who provide draught power as well as high butterfat milk in humid southern Asia, will not be replaced by Holstein cows. The indigenous breeds have developed as they are, precisely because of their

Photo by J. Rojas

adaptation to the local climate, to the available feed supply, and to the economic and cultural requirements of the people who husband them. They are also resistant to local diseases and other hazards, which often threaten imported breeds. Transplanting exotic temperate breeds does have limited application however. Successes with the introduction of crossbreeds established the direction of livestock development projects. Outstanding temperate breeds crossed with local breeds produced hybrid vigour (heterosis) so well known to plant breeders, combined with adaptation to the local environment. The problem is their hybrid vigour is not passed on to their offspring, and purebred herds are required to produce further hybrid offspring.

In addition the best specimens of local breeds were generally the first to be used in the crossing trials and so were not maintaining the vigour of the original breed lines. And secondly, the genetic composition of a livestock population can shift very quickly as shown in Norway with the Norwegian Reds, or England where Herefords and Holstein-Friesians virtually replaced the British Shorthorn after the Second World War. In response to these changes, the Food and Agriculture Organization (FAO) conducted a breed survey of Europe and the Mediterranean basin in 1975 and concluded that fully 115 livestock breeds were endangered while only 30 were still holding their own.

FAO LIVESTOCK SURVEY

These discoveries led to the realization that little-studied and little-known indigenous breeds, which might have real potential for contributing to livestock breeding, might soon be lost. To forestall this possibility, FAO began surveying indigenous livestock, beginning with the Zebu-type breeds of India and Pakistan in 1953, African cattle in 1957 and water buffalo in 1974. The National Science Council in Washington has since participated in studies of buffalo and of underutilized species of Asia. The Society for the Advancement of Breeding Researchers in Asia and Oceania (SABRAO) is compiling an inventory of genetic resources. The Government of India has established a Bureau of Genetic Resources and the Minor Breeds Conservancy in Massachusetts has recently begun an inventory for the United States.

But is this preservation of displaced or little-known breeds mere sentimentalism, like collecting antiques, or can these "obsolete" breeds have some further value? We have learned from plant breeding that a very highly refined and uniform strain often exhibits extreme vulnerability to new diseases, to environmental changes and to changes in technology and consumer tastes. The

result is a selective return to greater genetic diversity through "back-breeding" to primitive strains with particular disease resistances or other qualities missing in the high-yield breeds. The important difference between plant and animal germ plasms is that plant seeds can be easily stored in hermetic containers — even in clay pots inside a pyramid — for long periods until they are needed. But livestock germ plasm can only be preserved in active breeding herds, which



The versatile water buffalo provides leather, meat, milk, draft power — and transport for this boy in the Philippines.

are both more costly and more vulnerable.

A number of indigenous livestock breeds are currently being investigated by researchers, either for their direct potential as livestock or for the genetic contribution they may make to more productive breeds. As part of this effort, IDRC has been helping support the International Livestock Centre for Africa (ILCA) based in Addis Ababa. This group has been studying breeds of cattle and goats which are resistant to trypanosomiasis. This deadly sleeping sickness carried by tsetse flies drastically limits the productivity of livestock and the use of draught animals in much of humid Africa.

Resistant (trypanotolerant) breeds such as the N'Dama or Dwarf Shorthorn cattle are considerably smaller than susceptible

breeds. However, early studies indicate that, they can be just as productive when compared on the basis of production per unit of body weight rather than production per individual animal. In other words, five resistant N'Dama cows weigh the same as four non-resistant Zebus and produce the same volume of milk and weight of calves. Unfortunately the trypanotolerant breeds are dwindling. The Dwarf Shorthorn is considered to be endangered. If rescued in time, these breeds might eventually allow for the expansion of significant animal husbandry into regions where sleeping sickness is ending and now enforces the hoe as the principal means of cultivation.

RESEARCH ON CAMELIDS

Another IDRC-supported project is studying the use of by-products as protein supplement for indigenous cattle of Bali. (See accompanying article.)

In South America, IDRC is supporting several projects doing research on camelids — llamas, alpacas and their wild relatives, the only livestock suitable to the high altitudes they inhabit. Although domesticated since before the Incas, alpacas have been reared in small herds and have not previously been systematically selected or managed for improved characteristics, such as a white coloured coat to provide a higher grade of wool.

In El Salvador IDRC is supporting investigations of the native swine, owned mainly by the poorest farmers of the country. Ninety-six percent of the rural pigs of El Salvador are descended from Chinese stock introduced by the conquistadores in the 15th and 16th centuries. They have adapted to the hot, humid climate and an almost consistently protein-poor diet to produce a breed unique to this environment. The present researches have already indicated that supplementing their mainly forage-based feed with green weeds and a fermented sorghum meal, can improve their feed conversion efficiency significantly from 7.6:1 to 4.4:1. Other findings will undoubtedly lead to improved breeding and management practices without sacrificing the acquired hardiness of these native swine.

When the very last giant wild ox, *Bos primigenius*, ancestor of all domestic cattle, was slain in Poland in 1627, world cattle became, as it were, genetic orphans, selected and cross-bred strains of a wild gene pool evolved over thousands of years, which no longer exists. Contemporary breeds are vulnerable enough to all but disappear in a single generation, in some cases, just as researchers are beginning to unlock some of their hidden, or at least not well known, potentials. □

David Creighton is an Ottawa writer and former livestock breeder.



Photo by Ken Mackay, IDRC

The "thrifty" Banteng thrives even on poor pasture land.

THE UN-CATTLE OF BALI

ANNE FISHER

Although they look like cattle, the Banteng or "Bali cattle" are an entirely different species from European or African cattle. The cows are light brown and stand about 1.2 m tall, the bulls are almost black and a little larger; both sexes have white legs and a white patch on their rumps. These delicate looking creatures have been domesticated since prehistoric times and their uniqueness has been protected since 1913 when crossbreeding the Banteng became illegal in Bali.

Today, there are an estimated 1.5 million Banteng in Indonesia, making up about 20 percent of all the "cattle" raised. They have an excellent dressed weight as a proportion of live weight and an unusually low fat content. Their lean and tender meat is

prized in the markets of Hong Kong and Japan and they are considered easier to train for farm work than Zebu cattle. Banteng are particularly well adapted to the hot humid climate and are resistant to ticks and tick-borne disease, tolerant to liver flukes and relatively unaffected by Asian trypanosomiasis (sleeping sickness).

But the most amazing thing about them is their ability to maintain body weight and condition on poor grazing. Banteng, like water buffalo, survive well even on pasture that is unpalatable to cattle, but it takes up to six years for them to reach market weight of 400 kg. With financial support from IDRC, Dr Made Nitis of Udayana University recently completed a five-year study of the effect of supplementing the traditional diet

of grass and weeds with higher protein agricultural by-products.

GOOD PASTURE RARELY AVAILABLE

Research had already shown that these bovines could double their rate of gain on improved pasture. However, good pasture is rarely available to the subsistence farmers of the area who keep two or three "cattle" and crop their small plots intensively. An alternative is to supplement the traditional low-protein diet with rice bran, copra meal (a by-product of coconut oil), cassava chips and even poultry manure.

Each year the island of Bali produces 170 000 tonnes of cassava chips, 65 000 tonnes of rice bran from mills and 50 000 tonnes of factory-processed copra meal. The quantity of copra meal and rice bran produced on small farms probably exceeds that produced by the formal sector of the economy.

HIGH ROUGHAGE DIETS

Initially Dr Nitis tested diets based on the protein levels suggested by the United States National Research Council standards. He found that the Banteng gained faster than expected and that a more economical feed ration was appropriate to these thrifty animals. Although "Bali cattle" have a similar feed conversion ratio to true cattle breeds when fed high-quality feed, they seem to be more efficient on high roughage diets. The modified rations that were eventually adopted are economical and can triple the growth rate so that market weight is reached in two years instead of four to six. Of several diets tested, the most economical was 70 percent roughage, supplemented by either 20 percent rice bran, and 10 percent poultry manure or with 10 percent rice bran, 10 percent copra meal and 10 percent cassava chips.

The researchers were surprised to find that the animals at the research station fed only grass gained more slowly than another control group being raised by local farmers. After studying the traditional diet more closely, they concluded that the traditional practice of supplementing grass with tree and shrub leaves during the dry season significantly increases the protein content of the on-farm feed. The feeding trial also showed that the Banteng seem to gain more slowly after they reach 350 kg and Dr Nitis has recommended that the legislated minimum market weight of 400 kg be altered.

SOURCE OF FOREIGN EXCHANGE

The government of Indonesia recognizes the role of the Banteng in the mixed farming economy of Bali. The smallholders grow crops for local consumption and livestock for draft and cash income. On the national level the sale of cattle is a major source of foreign exchange and an asset to the growing tourist industry. With government encouragement, research into improved pasture varieties, as well as breeding and disease control in the three major types of "cattle" (Madura, Ongola and Banteng) is progressing. The project funded by IDRC complemented the national research effort to increase the productivity of the Banteng and should ensure this hardy breed a lasting place of importance in the Balinese economy. □

STRANGERS IN THEIR OWN LAND

MIGRATION WITHIN IVORY COAST

JACQUES DUPONT

Scarcely a trickle in the 1950s, internal migrations in the Ivory Coast accelerated when the West African nation gained independence in 1960. Since 1970, these population movements have increased at an alarming rate. Massive migrations from the Central region to the Southwest of the country are causing conflict between tribes competing for scarce agricultural land.

The Institute of Tropical Geography (at Ivory Coast National University) has just published a report indicating that the days of easy expansion of land holding may have come to an end. The report sums up the findings of an exhaustive study, undertaken with IDRC support, of the country's dramatic population shifts and their possible socio-economic and political consequences.

The focus of attention is on the Baule, one of the most migratory peoples in the Ivory Coast. Many lived in the areas where the Koussou Dam was built. When their land was flooded, the government helped 75 000 people move to designated resettlement areas close to the large forests of the less populated Southwest. In recent years, inclement weather has caused a series of poor harvests on the remaining arable Baule homeland. As a result, one-third of the approximately 1.5 million Baule have now permanently left their traditional homeland and are living in other areas of the Ivory Coast.

*"For the immigrants,
the problem lies in
legitimizing their
claim to land
in the Southwest."*

PROPENSITY FOR EMIGRATION

The Baule people make up nearly 20 percent of the population of the Ivory Coast, and they have a very high birth rate. Social and historical conditions have made them particularly skilled in agroforestry, but about two-thirds of their remaining land lies outside the zone where cash crop farming is profitable.

Those involved in the agricultural migrations are almost exclusively between 20 and 45 years of age; they are the ones most capable of establishing plantations. Under the age of 20, a man is generally considered

too young to assume such responsibilities; over 45, he is too old.

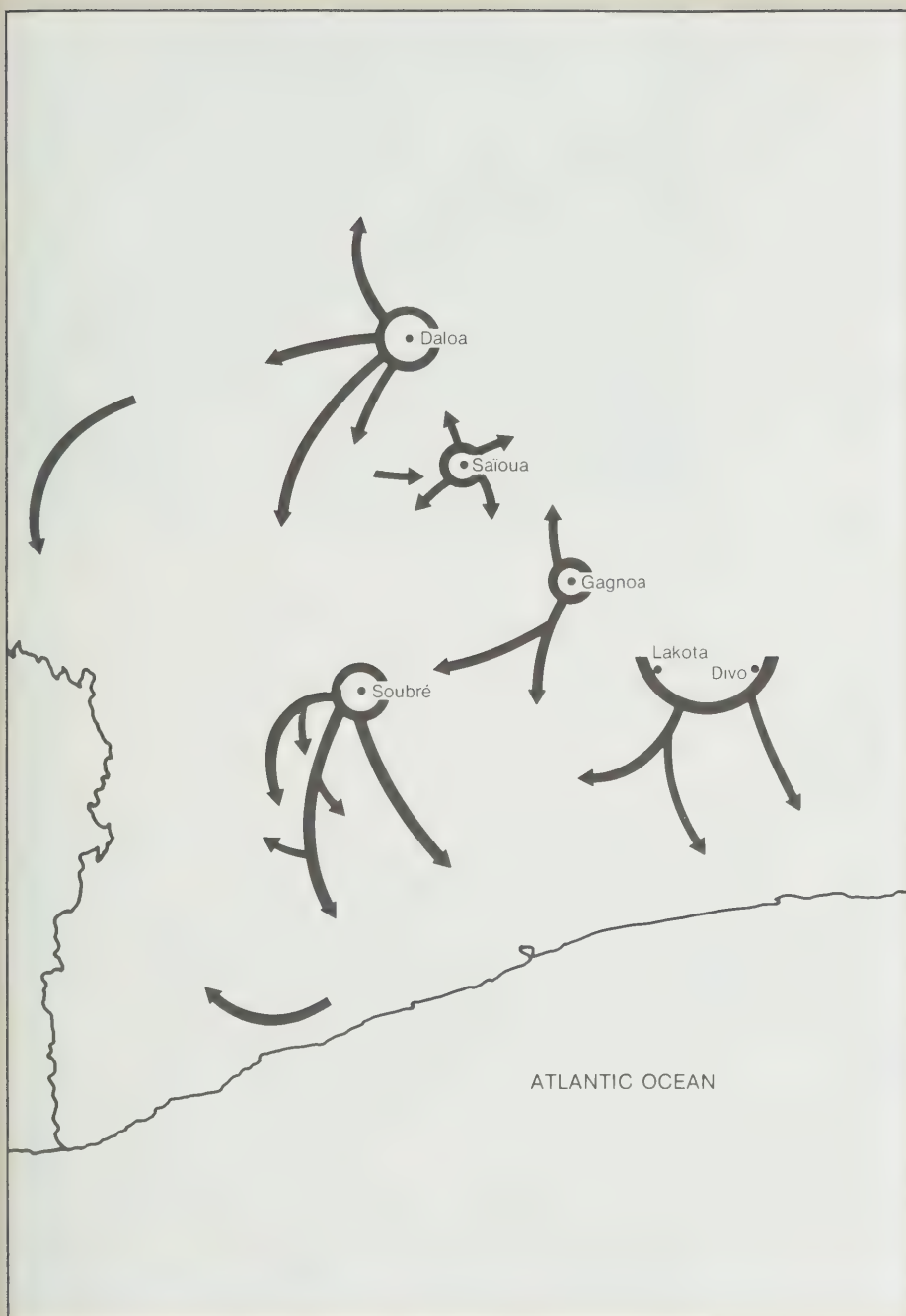
FEMALE MIGRATIONS

While men account for 53 percent of the migrating population, women make up the remaining 47 percent. The situation is peculiar to the Baule whose relatively flexible family structure allows adolescent girls to embark on migratory adventures with their parents' blessing.

The city is a refuge in which the woman can escape traditional restrictions and acquire a new social status based on money. A woman in the village can seldom subsist, much less gain prestige without the support of a man. Only in the city can she make it on her own.

The exodus is growing among young women between 15 and 19 years of age. They go to Abidjan, Bouaké or Yamoussoukro where they can work as housemaids or engage in clandestine prostitution and earn a substantial amount of money.

The girls often return to their village wearing beautiful loincloths and steeped in "the ways of the city", easily impressing their mothers who encourage daughters still at home to try their luck in the city. Thus, the stout Baule woman, divorced or single, who is the owner of a restaurant-bar, or is a businesswoman supporting a number of dependants, is a familiar sight in Ivory Coast cities.



IVORY COAST — Migration patterns of the Baule people.

BAULE SOCIETY

The Ivory Coast's accession to independence resulted in many changes in the country's traditional social structures. However, the Baule still live largely according to ancestral customs.

Traditionally, a person's prestige depended on the family's social status and each person was judged according to the services he or she rendered to the community.

With the development of a market economy, the old social hierarchy based on traditional values was replaced by a new one based on money. The traditional control mechanisms applied by the community on its members are thus becoming increasingly ineffective. Individual success comes first.

However, one cannot over-emphasize the significance of the rural Baule's traditional subordination to the mystical and to the sacred. These factors have significant impact on their initiatives and behaviour,

forbidding some activities and permitting others. Far from considering drought as inevitable and a poor harvest as the result of human error, for instance, the rural inhabitants perceive them as punishment inflicted by the heavens for the sins of the group or of one of its members.

DANGEROUS STRANGERS

There have thus far been no recorded unions between Baule farmers and women from the new regions into which they have moved. This is indicative of the communities' inability to intermingle and overcome their differences. Cross-cultural relationships, with their well-known positive effects, are discouraged by language barriers as few, if any, Baule planters speak Bete or Bakwe, the major dialects of the Southwest.

For the locals, the immigrants are foreigners who have brought dangerous fetishes which can destroy harvests. Reports of witchcraft attributed to the newcomers cast a pall over the social climate in the host regions.

For the immigrants, the problem lies in legitimizing their claim to land in the Southwest. Ivory Coast law holds that land belongs to the person who cultivates it. According to the legislators, this encourages economic development since it is likely to break down the ethno-cultural barriers to progress. The quest for legal land ownership appears simpler than it really is.

This law flies in the face of the unwritten rule that land belongs to the ethnic communities occupying it. Custom dictates that land is inseparable from culture, religion and, in particular, ancestral rights. In this framework, it is impossible for individuals outside the ancient culturally-based ownership patterns to truly own a parcel of land.

It seems unlikely that the Baule, so steeped in their own customs, would use the legal ammunition of today. Yet, Baule immigrants often turn to modern laws when their hosts fail to respect their agreements. Such cases clog the courts in Soubre, Sassandra, Gagnoa and Daloa.

The local inhabitants have devised their own strategy for discouraging Baule settlers. One mechanism is the strengthening of old religious rules governing property administration. And religious sanctions can be particularly effective in a milieu so tied to ancestral traditions.

The issue of ownership of farmland is not the only one raised by increased migration. Protected forests, considered by many tribal chiefs as being under their jurisdiction, are continually being encroached upon. As the tide of migrants puts pressure on the cleared arable land, the newcomers move into the forests, clearing and cultivating new farmsteads.

A PATIENT PROCESS

It was thought that migrations from the Central region to the sparsely populated Southwest would offer a solution to the problem of developing that region's forests. But the situation is in fact quite different. In many areas, the tolerance threshold has been reached and local people who have been passive for many years are beginning to be openly negative to immigrants.

These factors indicate that there is a need to manage a process whose scope has gone beyond the responsibility of the individuals involved. The problem is far from simple, however, for poorly-gauged government intervention may lead to a political polarization of situations to which there is already too great a tendency to attribute tribal overtones. One of the most pressing tasks is to bring together the political and administrative leaders from regions that the Baule are leaving and those in which they are arriving. In this way, both individual and government interests could be protected.

In this regard, the population migrations occurring in the central region of the Ivory Coast certainly afford valuable lessons for other countries in Africa and in other continents faced with a similar situation. □

This article was written from a study by D. Hauhouot Asseypo, Assa Koby and Atta Koffi, De la savane à la forêt : Étude des migrations des populations de Centre-Bandama. Mémoires et documents de l'Institut de géographie tropicale. Université nationale de Côte d'Ivoire

SMALL IS PRODUCTIVE AND NUTRITIOUS

NEW RESEARCH FOR IMPROVING SMALL-SCALE FOOD INDUSTRIES

LORNE PETERSON AND BILL EDWARDSON



Photo by Bill Edwardson, IDRC

In Malaysia, dough is formed to make fish crackers.



The origins of soysauce: Beans fermenting in the Singapore sun.

The beaches along the east coast of Malaysia are scattered with small fish cracker factories. One walks past the men who are deboning the fish outdoors, into the buildings where the fish is mixed by hand with flour and water. Women work rhythmically at a table, rolling out the dough which is then steamed over an open fire before it is sliced and taken outdoors to be sun-dried on racks.

In Santiago, Chile, almost every corner has a bakery that produces hot bread three times a day. In Singapore, the soysauce manufacturers blow piercing whistles to summon the neighborhood women from their homes to help cover the rows of porcelain fermentation jars when it begins to rain.

These small but ubiquitous food processing enterprises, often family owned and operated, provide employment and income for a large number of people. They are also a primary source of low-cost traditional foods for the majority of people in developing countries. Yet despite their importance in everyday life and their potential contribution to economic development, these enterprises will become less and less competitive as they are left behind in the thrust to modernize industry.

SMALL-SCALE OPERATIONS NEGLECTED

In the last five years, however, IDRC-supported projects have been initiated in several developing countries to begin building research and industrial extension services for small food processing enterprises. Most food-research scientists and technologists in developing countries have little experience in serving the needs of small- and medium-scale food processing enterprises. They usually work in national institutes and government programs that mainly provide technical and research support services relevant to large-scale companies. This has led to the neglect of the research and development needs of small food processing businesses, and food researchers have lost touch with the traditional food industries in their countries.

Because the small-scale food processing sector is made up of indigenous enterprises that use local skills and resources, often in rural areas, more governments are beginning to appreciate the vital role it can play in strategies aimed at producing self-reliant economies. There is also a growing recognition of the contributions small food processors can make towards achieving the goal of self-sufficiency in food, since these enterprises ensure the availability of indigenous processed foods.

LACK OF TECHNICAL PERSONNEL AND CAPITAL

For these reasons, government policy-makers and food researchers are beginning to focus on the special needs of small food processing enterprises. Unlike large-scale food processors, small family-run businesses do not have the technical personnel and capital required to make use of the

advice given by a conventional industrial extension service. They also have difficulties in identifying and articulating their needs. Therefore, extension and research agencies in several countries are developing, with IDRC support, a new approach to assisting small food processors in improving their operations.

Instead of just giving advice, food researchers and extension staff are working directly with small businesses in their factories. They are helping them to identify their problems, and are working with them, within the constraints of their businesses, to suggest, test and implement improvements. This type of service began in 1979, when IDRC supported a project of the Singapore Institute of Standards and Industrial Research (SISIR) to develop improvements in processing and production control for traditional noodle and soysauce manufacturers.

In the case of the soysauce manufacturers, the manager of a small factory in Singapore agreed to participate in a project with SISIR to design and test a large fermentation tank, with the aim of reducing labour and space requirements. The traditional method for fermenting soysauce involves the use of several thousand porcelain jars, which take up a large amount of space; and much time is spent in covering and uncovering the jars (three or four times a day) because of frequent rains.

ROLE FOR FACTORY MANAGER

The factory manager provided labour, land and processing facilities, so that SISIR could do the research work in his factory. And he was fully involved in the design of the tank that was tested. The tank was made of fibreglass and had a capacity equivalent to 40 porcelain jars. It also had a transparent lid and a gap between the cover and tank body to reproduce the fermentation process of open jars, while at the same time, protecting the soysauce from rain.

A comparison test showed that the yield from the tank was 100 percent greater than that from 40 jars. The unique taste and aroma produced by the small-jar method, which is preferred by Singapore people, was not altered by the large-tank processing method. The tank also used 75 percent less space than the jars, and reduced labour costs considerably.

The factory owner was impressed with the success of the experiment and although he will keep some jars for particular customers who insist on soy sauce made the traditional way he decided to install large tanks at the rate of two per month. Space is now available for expansion with more job opportunities.

One of the important lessons learned by the SISIR researchers in this project was the need to develop appropriate methods for working within a small company environment. For this reason, IDRC decided to support an on-going program to assist food and industrial researchers to design and apply effective techniques for improving the production processes of small-scale food businesses.

Work has been done on developing appropriate research techniques through other IDRC-supported projects now oper-

ating in bakeries in Santiago, Chile, with coffee processing co-operatives in Guatemala, with fish-cracker producers in Malaysia and with fish-sauce producers in the Philippines. The research activities geared to small industries will likely become incorporated into existing research institutes in developing countries. This will ensure that more attention is paid to small industries and may lead to the identification of priorities in other fields such as product development, process development and packaging.

As the approach toward small-scale food processing becomes increasingly more scientific and systematic, the words of John Hawthorne, former head of Food Science at the University of Strathclyde, Glasgow must be remembered. "Before we even start to think about research, appropriate technology, systems analysis, technical services, resource audits etc. and long before

we begin to talk about science," he said, "we must try to understand the motivations of the business we are considering, the attitudes of the man who is running it, his level of education, his business worries, the family he has to support from it and his standing in his local community. We have to try, with sympathy, to understand his problem from his point of view, and also the needs of the people who work for him."

As government attitudes change and research efforts mature and strengthen the small-scale food industries, the 1980s may become known as the decade when "small" was demonstrated as being not only beautiful, but also productive and nutritious. □

Lorne Peterson is an Ottawa freelance writer. Bill Edwardson is IDRC's program officer for Post-Production Systems, currently posted in Bogota.



Photo by Bill Edwardson

In-factory experiments have improved noodle-making in Thailand.

BROKEN NOODLES

The owner of the mung-bean noodle factory was worried. Ever since he had moved his factory to a new site close to Bangkok, he was having a problem with broken noodles. The packages of noodles were being returned by buyers, and his business was suffering.

Bankruptcy loomed.

He thought the water at his new site was responsible for the breakage, and approached the Thailand Institute of Scientific and Technological Research (TISTR) to help him solve his problem.

TISTR showed him that the water was not to blame, but rather poor control over the key stages of noodle making.

LEVELS TOO HIGH

The noodle maker asked researchers to work on a more detailed study to improve his business. TISTR obliged, and concentrated on the sulphur and freezing stages of noodle making.

Noodles are exposed to sulphur (SO₂) fumes to preserve and to bleach them.

This factory was using unnecessarily high levels of SO₂, which may have been responsible for impurities and subsequent breakage in the final product.

In northern China, extruded noodles were packed in snow, outdoors — a freezing stage believed to contribute to the structural strength of the noodles. The modern factory in Bangkok followed the freezing practice, but put its noodles in large freezing rooms for 19 hours or more. However, TISTR found the noodle cooling racks were arranged so they blocked the flow of cool air. Each rack was brought into the room separately so the door was continually being opened, making the freezing even less efficient. These simple factors caused the temperature to fluctuate and reduced the quality of the noodles.

PRODUCTION TIME CUT

TISTR researchers experimented with process operations in the plant until they found the most efficient arrangement of cooling racks, loading systems and sulphur treatments. The time it took to make a batch of noodles was reduced from four days to two days. The owner saved money on electricity and sulphur and got a consistently high quality product. Not only was the owner saved from bankruptcy, but he is expanding his business and hiring more workers.

With experience in this and three other factories, the team organized a workshop to which all 23 small-scale mung-bean noodle manufacturers in Thailand were invited. Since many of the manufacturers had not welcomed previous approaches by TISTR, the research team was amazed when every manufacturer attended. The industry representatives prepared a list of issues that they wanted addressed by the research team.

The in-factory, individual, approach to research was obviously a success in this small-scale industry. □



Plantains are a popular food in Central Africa.

A boon to banana farmers

Millions of small farmers around the world depend on their home grown plantains and bananas for food. But increasingly, these two carbohydrate-rich staple food crops are threatened by a number of serious diseases.

One windborne leaf spot disease in particular has severely damaged crops in Southeast Asia and Central America in recent years — Black Sigatoka. The disease can be controlled to some extent by frequent fungicide applications, but because of the cost, this approach is practical only on large plantations, such as those run by commercial exporters. Most small farmers simply cannot afford such a solution. They need resistant plants and that means more testing of promising cultivars.

Farmers propagate bananas and plantains by cloning. From generation to generation, then, plants are genetically identical, making them particularly susceptible to diseases. While Black Sigatoka is probably the most serious threat at present, other diseases such as Bunchy Top (an aphid-borne viral disease) and Panama Disease (caused by a fungus) are also causing widespread damage.

Recognizing the need for urgent measures, a donor support group completed the first step in the formation of the International Network for the Improvement of Banana and Plantain (INIBAP) last November. IDRC agreed to be the executing agency, other donor organizations and countries include the Australian Centre for

International Agricultural Research (ACIAR), the International Fund for Agricultural Development (IFAD), and Belgium, France, and the U.S.A. INIBAP's headquarters in Montpellier, France will link banana and plantain improvement programs in Latin America, Asia, and East and West Africa. The network is intended to benefit farmers who cultivate the crops for home consumption. This sector accounts for 88 percent of production in more than 80 producing countries.

The two main thrusts of INIBAP's work will be to exchange germ plasm in the form of tissue culture and to test for disease resistance. The network will also support training for Third World researchers and technicians and will arrange for the collection and exchange of information on bananas and plantains. Much of the work will be in the form of assistance to national research programs.

Wanted: Third World science writers

Gemini News Service is looking for science writers. Since initiating its science and technology features service with assistance from IDRC's Communications Division in late 1984, Gemini has had good feedback on the usefulness and quality of this new service. But the flow of development science articles from Third World writers has been slow. Derek Ingram and Daniel Nelson, editors at Gemini (Gemini News Service, 40-43 Fleet Street, London EC4Y 1BT, England), are actively soliciting articles from writers in developing countries ready to turn their hands to science topics. Gemini provides editorial feedback on articles submitted, so writers have an excellent opportunity to improve their science writing skills.

Scientific editing: putting knowledge on paper

Scientific and technical editing is practically an unknown profession in

despite the fact that in the last 25 years, there has been a rapid increase in the number of research institutions. Without scientific editors with experience in production and distribution of publications, many of them cannot implement their publishing programs. But this situation is changing thanks to an IDRC-financed project designed to rectify this shortage of skills in so vital a field.

The plan is to work toward a long-term solution to institutional publishing problems by helping local editors acquire skills in all facets of editing, producing, and disseminating scientific publications. According to the Project Adviser, Helen Van Houten, "the main activity of the project has been upgrading the participants' skills by working on a one-to-one basis on their own publications programs."

A workshop held at Duduville, near Nairobi, Kenya, was a major ingredient of the project. It provided "outreach" opportunities for the project leader and the Nairobi-based participants to pass on the skills they had learned to 34 technical and scientific editors from 12 countries in the region.

One participant, James Katorobo from the Eastern and Southern Africa Management Institute (ESAMI) based in Arusha, Tanzania, said: "I was recently appointed head of a newly established publications unit in my organization although I did not have editorial skills. This workshop came just in time and I am going to apply skills acquired during the two weeks to design a newsletter for my institution."

Most of the participants, although working as editors in their respective countries, said that they had never had an opportunity of learning from people with experience nor had they known about style manuals — the working tools that are so important to a practising editor. The majority of those attending the workshop were senior editors or production managers in universities, regional research centres, international research organizations, government publishing houses, national bureaux of standards, and national research institutions.

Fibi Munene, IDRC Regional Liaison Officer, Nairobi.

Chicken feed carries vaccine

In Malaysia and other parts of Asia, many villagers and farmers keep a few chickens. These small flocks are an important source of protein for rural people but, at present, they are not very productive. A virus causing the highly contagious Newcastle disease is a major cause of loss. There is no Newcastle disease in Australia but there are unusual strains of the virus present there that are completely avirulent and cause no disease. Chickens infected with these strains produce antibodies against Newcastle disease and are protected against the disease when challenged with a virulent strain of the virus.

One of the Australian strains has been used to manufacture vaccines used to control the disease on large commercial poultry farms, but they are expensive and difficult to administer. It is from this strain that an Australian research team hopes to produce a vaccine and a simple, cheap method of vaccination that could be applied to village poultry.

In Australian experiments, chickens developed antibodies after the vaccine was mixed in their feed. Malaysian research showed that the majority of chickens vaccinated by feeding, or by contact with vaccinated birds, were resistant to Newcastle disease.

The Malaysian workers have also devised a method of coating pelleted food with the virus; the vaccine on the pellets remains infective for several weeks. Contacts have been made with several Malaysian villages, which will be supplied with vaccinated chickens. After several months, other chickens will be bought from the villagers and challenged with Newcastle disease virus.

Already there have been enquiries from other Asian countries and from Africa, and it is hoped that the vaccine may be of benefit in the many countries where poultry supplies an important part of the people's diets.

Janeen Samuel, University of Queensland, from Australian Centre for International Agricultural Research Newsletter.

IDRC'S 15TH ANNIVERSARY

FOR THE

BENEFIT OF PEOPLE

IVAN L. HEAD

When Parliament created IDRC in 1970, it did so with some excitement and with a clear sense of purpose. Members of Parliament were dedicated to the design of an unusual organization, one with an international character and an unprecedented degree of independence. During the House of Commons debates they indicated that they wanted this new assistance vehicle not only to focus on science and technology, but to take on a distinctive character.



Ivan L. Head

In the process, Parliament left no doubt that what was being conceived to help solve the complex problems facing the developing countries was something quite novel: a mechanism which would utilize innovative approaches, would emphasize the advantages of flexibility, would exhibit sensitivity and responsiveness to developing country priorities.

Never before had an OECD country publicly declared its intention to create — and to finance entirely — an international institution, to free it from the burden of domestic bureaucratic constraints, to encourage it to pursue single-mindedly development effectiveness. At once, a new standard of development cooperation was set, and new expectations created within Canada and abroad about the quality of the assistance to be offered. Those expectations were reflected in 1981 by the Auditor General of Canada when he undertook a comprehensive examination of the Centre's effectiveness. In his report to Parliament the following year the Auditor General stated: "IDRC operates with highly qualified, experienced and dedicated professional staff, many of whom are internationally renowned in their fields. Most project recipients we interviewed considered the IDRC approach superior to that of other international aid agencies."

DISTINGUISHED BOARD

One of the keys to the Centre's effectiveness continues to be its international Board of Governors. The Board has evolved as one of the world's most distinguished groups of scientists, and now enjoys an unquestioned reputation as the single most competent and experienced council of

"Quality of life and individual human dignity are the goals."

development research experts to be found anywhere.

The Centre's superbly qualified natural and social scientists represent the comparative advantage of IDRC. Their advice and their views are continuously sought by scientific institutions, by international organizations, by governments. They function from Ottawa and from six regional offices located in Africa, Asia, and Latin America. Centre employees blend a distinctive mix of sectoral and geographic qualifications and experience, possess among themselves hundreds of university degrees and technical certificates, speak fluently more than 60 languages, come from more than 50 countries. Most important, IDRC scientists without exception work in the field.

IDRC views development as a process for the benefit of people: in largest number, rural; in greatest need, women. The Centre has learned that development is a complex matrix of ingredients and problems, none of which are unrelated to others. It under-

stands that development is investment — of people and resources — and that development decisions are investment decisions. Those most capable of identifying the problems, assessing the risks and fixing the priorities are the peoples of the developing countries themselves. They are the engines of development; they are the instruments of change. They are the partners and the beneficiaries of IDRC activity.

The Centre is well aware that development is a qualitative exercise much more than a quantitative one. Quality of life and individual human dignity are the goals. Raw economic statistics can be confusing and tempt short-term, quantifiable activities at the expense of genuine development accomplishment. IDRC endeavours to blend judiciously and sensitively its own experience with the identified long-term needs of the developing countries, and to act both as a catalytic and a supportive agent among other factors in the development community.

RESEARCH TO SOLVE REAL PROBLEMS

All these things IDRC has endeavoured to do in the past 15 years. Its goal in the future is to be even more effective, to be more responsive, to draw the correct lessons from the circumstances it encounters. It will remain emphatic in its insistence that research projects must address real problems and that research results must be utilized for the benefit of those most in need. Central to all else, however, IDRC will remember that its role is a subsidiary one: to help developing countries help themselves. □

Ivan L. Head is President of IDRC.

THE CHANGED CONTEXT OF SCIENCE AND TECHNOLOGY FOR DEVELOPMENT

FRANCISCO R. SAGASTI

"International support for development is now flagging. In some of the rich countries its feasibility, even its very purpose is in question. The climate surrounding foreign aid programs is heavy with disillusion and distrust . . . we have reached a point of crisis. . . . Our travels and studies have convinced us that we have come to a turning point. On all sides we sense a weariness and a search for new directions."

Partners in Development,
Report of the Pearson Commission, 1969.

"In the 1980s and the 1990s technological advances in a number of fields . . . are expected to converge leading to a significant measure of technical change. These advances are unique in their intensity and wide ranging impact. . . . (They) are expected to alter the rate and pattern of industrial production in the present and coming decades, . . . to widen the technological gap between developed and developing countries and accentuate the technological dependence of the latter, and to change the lifestyle of their people."

Report of the International Forum on
Technological Advances and Development, UNIDO, April 1983.



How has the international context for development evolved since 1970? What major changes and trends will condition the prospects of developing countries through the end of the century? The two quotations above — even though separated by 15 years — provide a good indication of the present climate for development assistance, and of the challenges faced by international support for science and technology for development.

There is no doubt that the 1970s and the early 1980s have been a period of accelerated and turbulent change, particularly in fields as dynamic as science and technology. This has modified the context

for institutions, such as IDRC, which operate at the interface between science and technology and development assistance. A brief review of some major trends and changes will help to place the impact of IDRC in perspective.

A PERIOD OF FERMENT AND RENEWAL

The late 1960s were characterized by great optimism about the contributions that science and technology (S&T) could make to the benefit of mankind. The "if we can

put a man on the moon, then we certainly can . . ." syndrome dominated thinking about S&T for development. The United Nations Committee on Science and Technology prepared a "World Plan of Action" for applying S&T in developing countries and the successes of the "green revolution" fueled the imagination of developing country governments and of international foundations.

The Canadian social and political scene also appeared quite favourable for exploring new ways of assisting developing countries. The Pearson Commission raised Canadian consciousness about development issues and also laid the foundations for a

renewed international commitment to multilateral development assistance.

The combination of renewed concern with development assistance and great hopes in the potential contribution of science and technology to development characterized that period of ferment of the late 1960s. Perhaps the creation of IDRC was the best institutional expression of this combination of concerns and hope.

RAPID GROWTH IN R & D EXPENDITURES

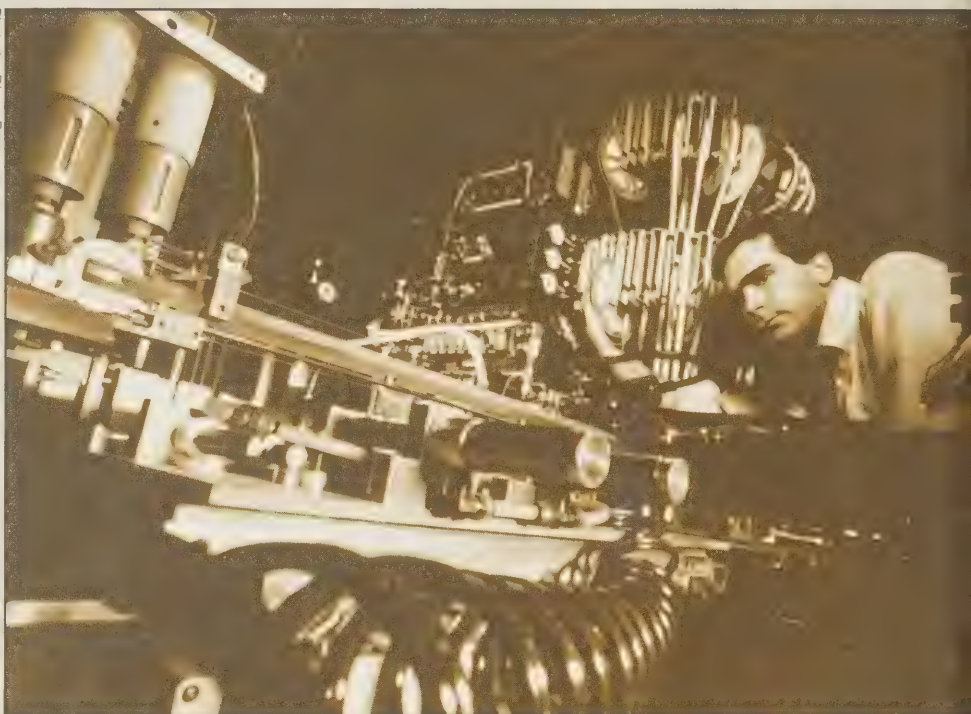
As a consequence of these high expectations about the potential contribution of science and technology, many developing countries — often with the assistance of international organizations, development agencies, and private foundations — embarked on determined efforts to expand and consolidate their scientific and technological infrastructures. Emphasis was placed on applied scientific and technological knowledge, particularly in fields related to basic needs, such as food, housing, sanitation, and education. Science and technology policy agencies multiplied in the developing countries, the number of research institutes increased substantially, and human and financial resources devoted to S&T expanded rapidly.

Research and development expenditures in Latin America, for example, increased from about US \$250 million in the mid-1960s to around \$900 million in the mid-1970s, and to nearly \$1,600 million in 1980 (all figures expressed in constant 1970 dollars). Efforts by some South Asian and Southeast Asian countries were also remarkable: S&T expenditures in India increased by a factor of ten between 1970 and 1980; South Korea raised R&D expenditures from 0.48 percent of GNP in 1970 to 0.91 percent in 1980, when the average annual GDP growth was 9.1 percent; and many other countries such as Thailand, Indonesia, and Singapore made significant efforts to consolidate their research and development capabilities. African countries such as Senegal, Kenya, and the Ivory Coast also expanded their scientific infrastructures, particularly in agriculture, while Egypt restructured its research institutions. Furthermore, countries like Saudi Arabia and Kuwait adopted ambitious plans for developing their scientific capabilities. However, despite all of these efforts, the share of world R&D expenditures accounted for by the developing countries remained quite low: estimates indicate that it may have risen only from 2 percent in the late 1960s to nearly 4.5 percent in the early 1980s.

The 1970s also witnessed the two oil price shocks that disturbed the placidity of economic growth in industrialized countries. This was accompanied by a growing retreat from the commitments to international development assistance by industrialized nations, partly as a result of economic difficulties at home, and by a slower pace of economic growth in most developing countries.

"It is clear that the concept of scientific and technological capabilities for developing countries will need a thorough revision in the near future."

Photo by Diane Bourgeois



Scientific and technological advances during the decade were dominated by the spectacular progress in microelectronics. The increasing capacity and decreasing cost of microchips helped launch a veritable new industrial revolution. Furthermore, advances in biotechnology, new materials, telecommunications, new and renewable energy sources, space technologies, and so on, also began to herald the emergence of the new S&T context that is taking shape as the 20th century draws to a close.

DEVELOPING COUNTRY CONCERNS IN THE FIELD OF S&T POLICY

The UN Conference on Science and Technology for Development, held in Vienna in 1979, marked the international legitimization of a number of concerns of developing countries in the area of S&T policy. Many of the issues debated at the conference emerged from studies conducted during the 1970s on the role of S&T in developing countries, and out of the experience of nearly two decades of experimenting with S&T policies. As the only

international funding agency supporting a sizable research program in the field of S&T policy, IDRC had a significant — although indirect — impact on the issues that were examined at the Vienna conference. Problems such as the effectiveness of various S&T policy instruments, the nature of the S&T infrastructure, the role of minor innovations in industry, the conditions for the absorption of imported technology, and others of similar character, were brought into the conference room as a result of studies conducted in many developing countries, many with IDRC support.

The "Vienna Programme of Action" approved at the Conference is a compendium of sensible recommendations for developing indigenous S&T capabilities, for restructuring international scientific relations, and for reorganizing the UN machinery in order to make it more responsive to the needs of developing countries in the field of S&T for development. As such, it embodies the accumulated knowledge about S&T policies for development and is still valid in the 1980s.

Unfortunately, many of these recommendations remain on paper only, particularly those involving international initiatives such as the creation of a UN financing system

to support S&T development in Third World countries. Furthermore, while the program of action synthesized the collective wisdom of those engaged in S&T for development during the 1970s, it did not cover adequately the S&T advances that were in the process of changing S&T in a global context.

THE TURBULENT '80s

The transition to the 1980s was rather upsetting and uncomfortable for most developing countries. The world crisis of 1981-1982 halted economic growth in practically all developing countries, and in many of them turned back the clock nearly a decade in terms of per capita income; the growth of world trade slackened, commodity prices fell, and the terms of trade between developed and developing countries changed significantly against the latter; the foreign debt of developing countries increased substantially, particularly in Latin America, and rising interest rates made the burden of payments almost intolerable; the redeployment of industrial production from developed to developing countries slowed down markedly; and ineffective and wavering economic policies in developing countries often compounded the impact of these negative factors. Social demands such as health, education, food, and housing continued to rise — in close association with population growth — while the ability of governments to cater to them became seriously impaired.

Meanwhile, scientific and technological progress in the industrialized nations continued to make enormous strides in fields such as automation, composite materials, genetic engineering, tissue culture, and even space manufacturing that are being incorporated into production and service activities. In the field of telecommunications, for example, advanced telephone systems, computer facilities, video technologies, optical fibers and satellite transmission are creating a vast global network that a few years ago was not even considered feasible.

The complexity of the interactions between scientific research, technological development, and their economic exploitation has increased significantly. Combined with the application of technological advances to the conduct of scientific inquiry, this increased complexity is changing the very process of knowledge generation. For example, technological progress plays an important role in defining the agenda for scientific research, high-technology industries continuously identify new problems that can be addressed by science, and techniques of observation, testing, measurement and instrumentation are a major determinant of scientific progress.

The high cost of these advanced instruments makes them inaccessible to a large number of researchers, even in the industrialized nations, and places them out of reach for most scientists in developing countries. In addition, the institutional setting for the conduct of basic scientific research, applied technological research, and commercial development of new pro-

ducts is experiencing changes: links between university research and industry are being strengthened, collaborative industrial research has expanded, and venture capital firms are playing an increasingly important role in high technology fields.

It is clear that the concept of scientific and technological capabilities for developing countries will need a thorough revision in the near future. For most developing countries it will be necessary to select carefully the fields of specialization, to embark on a long-term process of developing human resources and research infrastructure, and to cooperate more closely with other developing and developed countries.

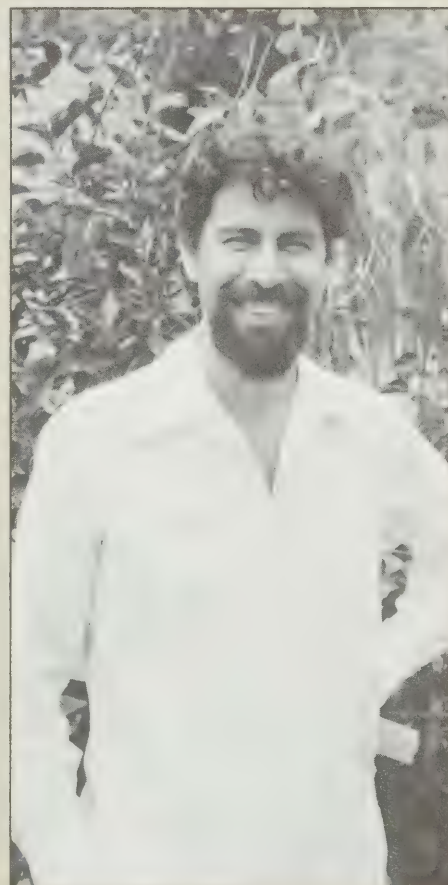
The paradoxical nature of the turbulent '80s — when scientific and technological advances appear to hold so much promise — is that the impact of the world economic crisis, of the adjustment policies followed by many developing countries, and of natural disasters is focusing attention and concentrating resources almost exclusively on the short-term problems of economic survival, while the essential but long-term task of building S&T capabilities to avoid those very same problems in the future is being neglected. The often quoted image of a peasant eating the seeds required for his next crop immediately comes to mind.

THE NEED FOR NEW INITIATIVES IN S&T FOR DEVELOPMENT

In 1985, 15 years after IDRC was founded, it appears that the international situation regarding S&T for development is rather similar to that prevailing at its time of creation. The worsening climate for development assistance is exemplified by the budgetary difficulties faced by the United Nations Development Programme (UNDP), the near collapse of the International Fund for Agricultural Development (IFAD), the troubles faced by the 7th International Development Association (IDA), and the failure of the United Nations Financing System for Science and Technology for Development. All indicate that there is a need for new initiatives in the field of development assistance. At the same time, the potential benefits of scientific and technological advances for developing countries continue to grow, although the process of making them effective is becoming more arduous.

However, a great deal has been achieved in the field of science and technology for development during the last 15 years. The few examples of research that are mentioned in this issue of *IDRC Reports* are an indication that, with the assistance of agencies like IDRC, the development of local S&T capabilities can contribute effectively to the improvement of living conditions in the developing world. The problem now is to modify the existing approaches to the mobilization of S&T for development objectives, adjusting them to the new situation, while simultaneously increasing the financial resources allocated for this purpose to a level commensurate with the task and the challenge. □

Francisco R. Sagasti is President of the Grupo De Analisis Para El Desarrollo (Study Group for Development), Lima, Peru.



Francisco Sagasti

FAMILLE ET DÉVELOPPEMENT

THE GRAND OLD LADY OF
AFRICAN PUBLISHING

JEAN-MARC FLEURY

URGENT STOP SOLD OUT STOP
PLEASE SEND ANOTHER ORDER

That's the sort of telex the publishers of the magazine *Famille et Développement* (Family and Development) in Dakar, Senegal, were getting this June. Zaire asked for 15 000 additional copies of the latest issue, three times as many as the original order. Abidjan, the capital of the Ivory Coast, sold its 5000 copies in less than a week and the distributor in Senegal asked for it to be reprinted.

Very few 'quarterly' magazines which have missed the newsstands for several months in a row

can claim such a faithful readership.

Why do the readers of *Famille et Développement* come running?

One ought to say, first of all, that this last issue was a 108-page special edition on sexuality. It was copiously illustrated and contained very thorough texts on masculine and feminine sexuality, childbirth and sexually transmitted diseases. In this issue, the publishers again tackled one of the topics which have brought this magazine to the forefront in almost all the French-speaking countries of Africa in 10 years of publishing.



During the first years of its publication, many of its articles did in fact deal thoroughly with sex education, health problems, the difficult relationship between parents and children in societies which are changing too rapidly, and, very tactfully, with subjects as delicate as the removal of the clitoris in girls, dowries (often too large), contraceptive techniques, etc. Marie-Angélique Savané, the editor-in-chief, regularly introduced her readers to subjects which had never before been so openly discussed nor with such a degree of discrete and polite authority. Well illustrated items and articles also presented concrete examples of successful experiments in community development, nurseries, credit unions, and cooperatives.

MADE IN AFRICA

However, what helped to make the publication even more attractive to its readers was that it was entirely written and produced in Africa. Readers felt close to this magazine which was produced locally and preached no line, either political or religious. The entire editorial team was in Dakar and the articles bore the signatures of specialists from various African countries.

Nowadays Marie-Angélique Savané is pursuing a brilliant career at one of the agencies of the United Nations. Pierre Pradervand, who was Director for the first years, continues the struggle for a better world from his native Switzerland. The only one left of the original team is the exuberant and talented layout man, Charles Diagne.

If the magazine has come to be quite famous in French-speaking Africa, it is not because it took the easy way. There would certainly have been trouble with the distribution of the last issue if it had been published and received from abroad. But no country has ever closed its doors to *Famille et Développement*. "You know," says Abdoulaye Malick Traoré, the current Director, "F and D has often dealt with issues regarded as taboo, and the magazine has never been impounded. These have, in fact, been the most successful issues. It may shock some people when certain problems are discussed, but", he adds, "someone has to say aloud what everyone is thinking about in their inward inside."

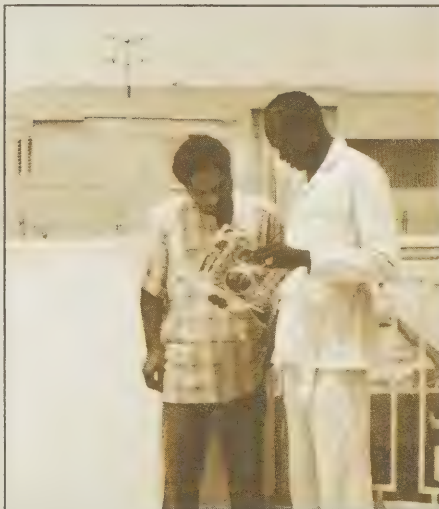
SURVIVAL WAS ESSENTIAL

F and D went through several difficult years, and its subscribers often had to wait several quarters for it. However, even African intellectuals, who had harsh things to say about some issues, felt it was essential for it to survive. As the only African, indeed pan-African, publication

among all the others written and printed abroad, it had to keep going. It was a matter of pride.

Not only is each copy read by a half dozen people, but the media, particularly radio, pick up its contents. "My wife has a complete set," says Armand Faye, who broadcasts popular science programs on Senegalese radio and television. "I regularly ask her to look out for information I can use in broadcasts, on such things as the therapeutic use of pawpaws which are common here." Many other journalists in other countries, as well as teachers and nurses, reinforce its impact on both adults and young people.

Between now and the end of the year the editorial staff should have moved to



Charles Diagne (left) and Abdoulaye M. Traoré of *Famille et Développement*.

Lomé (Togo), where the ASAFED (Association africaine d'éducation pour le développement — African Association for Development Education) publishing organization will have legal standing as an international organization. "The move will not involve any change in the editorial policy," stresses Mr. Traoré, who promises to maintain the original orientation while trying to make contents and format even better. In their new head office, the publication and its staff will no longer be subject to certain taxes and the relocation will put the magazine in the centre of its distribution area so that the cost of travel and communications will also be reduced.

So far, the magazine has been very dependent upon donors (IDRC from the start, the Ford Foundation, l'Action Carême Suisse, Swiss and Swedish aid, the United Nations, and now the Canadian International Development Agency). Now it seems that the management has decided to establish the publication more solidly in the region. The 35 000 copies of the special issue on sexuality, despite the relatively high price of 1000 CFA Francs (about CAD \$3.00), sold out very quickly. The cost of

distribution eats up about half the income from newsstand sales. But if the next issues (including one on health, and another special on sexuality dealing with contraception, abortion, sterility and deviance) sell as well, there is little doubt that the advertisers, who have held back so far, will come in and ASAFED hopes that the magazine will eventually make a profit.

Last year the magazine took control of its own distribution network, thanks to the efforts of Tossou Roger Adjalla, the head of sales and publicity. F and D now has everything it needs, including a unique capital of credibility with its public, to enable it to become a true medium of mass education and, at the same time, a profitable enterprise paid for by its readership.

Because of its popularity and its successful innovations, the magazine has had competition for about a year.

Several new publications, some put out by former collaborators, have appeared on the newsstands, particularly in Senegal.

As Abdoulaye Malick says: "F and D is probably what inspired these magazines because it has survived for 10 years, and its formula has been welcomed and accepted by everyone." He isn't afraid of the competition, "because F and D has an African and international reputation" but the appearance of these new periodicals certainly acted like the crack of a whip on the editors who might perhaps have been becoming less attentive to their public.

Twelve years ago who would have imagined that there would be really stiff competition between educational magazines in Senegal and other African countries?

PUBLIC IS THE WINNER

In other countries, Zaire and Cameroon in particular, new magazines concerned with health and educational topics have also appeared. In this battle of communicators and educators the public emerges as the big winner. The foreign publishers have continued to concentrate on politics, while a new generation of African magazines, published right close to home, slog away at informing their readers about health, education and concrete examples of development by local groups.

In these new marketplaces for ideas, a crucial discussion is carried on between intellectuals and the public at large about new values for an Africa in crisis. One can see that simply by looking at titles such as *Family and Development*, *A Better Way of Life* and *Living Differently*. Even if F and D does get washed away by the rising tide, the grand old lady of African publishing will have played the role of a quite exceptional innovator. □



A Malaysian villager demonstrates the power of plastic.

FROM WATERLOO TO THE WORLD

THE PVC PUMP BRANCHES OUT

DON SHARP

Three quarters of the estimated three billion people living in developing countries do not have access to adequate potable water supplies or sanitation facilities. In some places, such as the Sahel, water is not available without complex technology and high-cost construction. In many cities of the Third World piped water is available but is inefficiently used and inequitably distributed. Although these water systems are expensive and their cost a contributing factor to the national debt, they often benefit only a select proportion of the population.

Both of these problems are difficult to solve, but the majority of the world's population lives in rural areas where water is available, but is far from home and/or polluted with disease-carrying organisms. This situation does have a solution and IDRC has been a pioneer in developing a inex-

pensive and easily maintained handpump to supply villagers with clean water close to home.

The traditional local water hole, pond, creek or river serves reasonably well when population density is low. People, most often women, have carried water up long hills for thousands of years but as our world becomes crowded, many of these sources of water have also become sources of cholera and other water-borne diseases.

SOIL: A NATURAL FILTER

Luckily, almost every place in the world has a natural filter that can produce clean, safe water. That filter is the soil and the source of clean water is found below the ground. In order to tap the groundwater a well must be dug or drilled and to keep

the water that collects there free from contamination it must be sealed off from the surface, and pumped from the well.

The development of reliable handpumps that can be locally produced, installed and maintained at a reasonable price would be a major step toward providing reliable safe drinking water. The average pump costs about CA\$200 and more than 20 million of them are needed — the task is enormous. If any significant headway is to be made, it will not be just through governments and aid agencies but through the efforts of the rural people themselves.

HIGH STRESS, HIGH FAILURE RATE

One of the most important problems in rural water supply programs is the high failure rate of conventional manual pumps. The pumps break down because they were not designed for the level of stress and abuse they routinely receive in the rural areas of developing countries. Because the materials from which conventional pumps are made — mainly cast iron and steel — are not only expensive, but are not readily available locally, many developing countries must rely on imported pumps and parts supplied by international and bilateral donors. This presents difficulties in terms of maintenance requirements and procurement of spare parts.

Since 1976, IDRC has been supporting research on the development of more effective pumping systems for rural water supplies. The implications of new materials and improved pump designs were examined systematically. In view of the widespread introduction of plastics technology that has taken place in developing countries in the last decade, particular attention was focused on the polymer resins, specifically polyvinyl chloride (PVC) and polyethylene (PE). Both materials are widely available throughout Africa and Asia. In many respects, plastics technology is to developing countries what cast iron was to industrialized countries many years ago. The vast potential of plastics for use in handpump components has only recently been explored.

INTERCHANGEABLE COMPONENTS

The IDRC-sponsored design work centred on developing a simple, low-cost PVC piston and foot valve assembly for a manual, shallow-well pump. These below-ground components — the piston and foot valve — were designed to be interchangeable, thus saving labour costs in manufacture, simplifying maintenance procedures, and keeping the required number of parts to a minimum.

Early development research was carried out by a Canadian university, the University of Waterloo, and was completed in April 1978. The prototype pump assembly was then tested in England as part of a project sponsored by Britain's Overseas Development Ministry.

The Waterloo design was found to be reliable and efficient and differed from the others in the testing program in that it was designed specifically for manufacture in developing countries, using existing, locally available resources.

Believing that the straight transfers of technology are rarely successful, IDRC has a three-phase program for introducing the pumps to the potential users. Phase I was the field testing of the pump in Malaysia, the Philippines, Sri Lanka and Thailand in Asia and Ethiopia and Malawi in Africa. Research projects within the six countries tested the Waterloo design under a variety of environmental conditions, and appraised the appropriateness of the pump for local manufacture and for village-level maintenance. The original design was modified according to the availability of local materials in the villages.

The entire concept of a PVC pump was inappropriate for Ethiopia because PVC pipe made there is of poor quality. They have opted for a metal pump. The project in Malawi encountered a problem that it would have been hard to predict from Canada. Hyenas seemed to think the white PVC pipe on the pump looked like bone and chewed on the plastic fittings and spigots.

LEATHER VS POLYETHYLENE

In Sri Lanka, the PVC pipe has a rough inside surface which wore the polyethylene piston rings and prevented the formation of a really good seal. So the researchers replaced the polyethylene rings with leather cup seals which can easily be made in the villages. Another hitch — the solid PVC stock required to make the pistons and foot valves were not locally available. The team tried to make a "solid" cylinder by gluing progressively smaller PVC pipes inside one another but the ends tended to break off when the grooves were cut for the piston rings. Researchers tried to fabricate the piston and foot valve from wood but the piston rings stuck in the wood when it got wet and expanded and did not seal properly against the walls of the riser pipe. It was finally decided that importing pistons and foot valves from Malaysia was an inexpensive and efficient solution to the problems of quality control.

This unsophisticated wood and leather design makes local fabrication and repair possible, and has proven its reliability under field conditions. The use of leather instead of polyethylene rings meant that the seals wore out sooner but it also meant that villagers, who could readily obtain and work with leather, were able to replace the seals by themselves. Also, in Sri Lanka leather is less expensive than polyethylene.

In the second phase of the research the Sri Lankans are manufacturing their version of the pump through a network of cottage industries operated at the village level entirely by women. This research project is testing the feasibility of involving primary

"By promoting handpump manufacture as an income-generating activity, it is hoped that self-sustaining village-level industries can be established."

users — women — in all aspects of handpump development, from manufacture to installation and maintenance. (See article "Women of the pump".)

By promoting handpump manufacture as an income-generating activity, it is hoped that self-sustaining village-level industries can be established. It is also anticipated that by locating the industries as close as possible to the sites where the pumps will be installed any problems in pump operation and maintenance can be resolved easily.

In Malaysia, researchers found that despite obvious satisfaction and acceptance of the PVC pumps, the villagers seemed reluctant to purchase them, claiming they were too expensive. Local mass production is now making the handpumps more affordable. Research is currently under way

into mass producing them by injection moulding of plastics. The Malaysian government has supported the manufacture of 550 mass-produced models. The pumps will be installed and monitored by the Ministry of Health and experiments will also be done on their performance in medium and deep wells.

There are now four designs that have developed from the original Waterloo pump and there may soon be more because this second phase evaluates the pump, not only in terms of the production process but also in light of the "software" aspects of their use. How will the pumps be brought to hundreds of thousands of villagers, who will pay for them and who will maintain them? Patterns of village life will change with the introduction of the pumps and the pumps will be modified for specific conditions of local use.

A handbook illustrating the installation, maintenance and repair of the pump has been produced for use in the Philippines and Malaysia. A similar manual will be produced and distributed with the pumps in Indonesian and Thai villages.

The third phase of IDRC involvement with the pump will explore its commercial production. All too often development agencies consider their role to be the design and testing of a technology that may never be produced. Rather than assume that a proven innovation will attract commercial producers, IDRC is planning to take the pump to the entrepreneurs. It will support marketing studies, consult with lawyers about licencing and patents and work with governments and businessmen to establish controls over quality, pricing and installation of the pumps.

EXCITED ABOUT POTENTIAL

IDRC program staff are excited about the pump's potential for supplying clean water to rural people in developing countries. They are also pleased with the way the technology has been developed as a cooperative effort between researchers and users. They think that field testing and modification, incorporating the views of the users, is essential for the effective transfer of technology to the village level. If this strategy proves successful, it could be a useful model for the dissemination of other technological innovations.

It must be remembered that transferring a technology is not a simple case of financial resources, trained experts and a good design. It also involves complex social, cultural, political and economic considerations that are best — perhaps only — understood by the people themselves. Technology cannot be "parachuted" in. It must be examined, tested and modified according to local needs and available expertise and materials. □

Don Sharp is Associate Director, Water Supply and Sanitation, in IDRC's Health Sciences Division.



Photos by Anna Pissis

The technology of clean water: Gihilin Nona files a handpump component in Sarvodaya's workshop.

WOMEN OF THE PUMP

MALLIKA WANIGASUNDARA

In the months of June, July and August the earth in the villages of Kehelulla, Unapana, Serankada, Pallegama, Holike and many others in the Padiyatalawa Government Agent's Division bakes into a hard, impenetrable pan. As the rain clouds

drift away and the tropical sun bears down on these Uva villages, the burnt earth cracks.

Nature has inflicted its hardest blows on man and beast. Human beings and every kind of living creature pant in the midday

sun. Sapped of energy, their drying sinews thirst for water. But there is little or no water in sight.

This is Sri Lanka's dry zone at its cruellest. Even though rainfall in the dry zone averages from 100-150 cm annually and is higher than in the driest parts of the world, the middle of the year reduces wells, rivers and streams into muddy puddles or plain caked earth.

And in the burning heat women suffer most. They need water to cook, bathe children and themselves, wash clothes, and of course, drink.

THE PRICE OF BEING A WOMAN

Perhaps through centuries of trekking for miles in the boiling sun to collect water, the sinuous bodies of the women of the dry zone have adjusted, not only to the drudgery, but also to carrying a pot of water resting on their hips. It is the price of being a woman; it is her traditional responsibility to find the water for the domestic chores of the family.

So if now young women have come forward to be trained to produce water within sight of their homes, it is hardly surprising. For they have realized that unless they rely on themselves to pull women out of the drudgery of centuries, no one will.

The Sarvodaya Shramadana movement of Sri Lanka, the largest non-governmental organization in the country, is providing that opportunity. With IDRC assistance, the movement is now engaged in training women in handpump technology — manufacture, installation, repair and maintenance.

Earlier experiences in Sri Lanka and other parts of the world have shown that the villages in which pumps are installed are alienated from the technology.

"Once a pump broke down, it broke down and stayed that way. No one in those remote villages knew how to repair them," says Sathis de Mel, Administrative Secretary of the Sarvodaya organization.

"Our aim is to bring this technology to the village. Since women are the primary users, we have decided that the technology should be transferred to them. They are indeed willing receivers," he adds.

As you enter the Engineering Division of Sarvodaya, a few yards down the road from "Dam Sak", its Noratuwa headquarters, you are greeted by hundreds of metal chairs in the making. As you pick your way through the stacks of chairs and bundles of metal rods, the hammering inside the workshop gets louder. It is here that 10 young women, selected from remote Padiyatalawa, are learning a profession entirely new to women in Sri Lanka.

ADAPTED TO SRI LANKA

Soon they will be manufacturing water pumps, installing them, and teaching other women how to repair and maintain them. The pump they are learning to make is based on the IDRC-Waterloo pump, adapted to suit Sri Lankan conditions.



Changing roles: Women measure, machine and refine spare parts for pumps.

Most of the women have limited basic scientific knowledge, as facilities for offering science subjects and mathematics at the Secondary School level are primitive in the back woods of Uva villages. Although some of the women have some scientific education, to the majority of them, calipers and slag hammers, dividers, steel rules, arc welders and hacksaws are tools they are seeing for the first time.

The task of learning is uphill for them, but the spirit is willing — for they have had the daring to pick a vocation that is new and challenging. Clad in blue Mao-style trousers and tunics, their heads covered with porkpie caps of the same colour, the women are well on their way to learning the mysteries of how to fabricate a handpump.

NO WATER TO DRINK

Twenty-year-old Tamara Dharmasiri decided she would learn pump technology because she, along with the other inhabitants of Padiyatalawa, has suffered immensely without water even to drink.

"Sometimes," she says, "water had to be brought from Amparai by government bowser (tanker) from 50 miles away, just for drinking. Often we have to do without baths or manage with a bath in a muddy pool."

Her father is a small-time trader, while her mother is a hospital attendant. Coming

from a family of five children, she was at a loss as to what she could do for a living when she failed her Higher School Certificate examination. But even though she failed the examination, the knowledge of mathematics and science that she gathered helped her when her home village Sarvodaya centre was picking trainees to be sent to Colombo.

Now she is learning to draw up specifications for pumps, machining, shaving and welding the components.

Nandawathie is another trainee. Her father is a mason and manual work comes naturally to her. Her large family, five boys and five girls, works in the paddy fields and all of them know what a lack of water can mean both to the farmer and the individual.

But working in the fields did not prevent her getting an education which included science subjects.

"We have not yet reached the stage of fixing the pumps," she explains, "but I have learned to draw and draft the components and machine the various parts that go to make a pump."

"GOOD AND WILLING WORKERS"

H.E. Wijensa, 26, the Workshop Coordinator, describes the women as "good and willing workers". He says they are keen and make the best use of their time. Wijensa has been teaching basic engineering and technology both in Sri Lanka and in Indone-

sia, but this is the first time he has taught women. The Sarvodaya/IDRC project hopes to set up workshops, which, along with 50 handpumps, will be of benefit to about half the people in the Padiyatalawa Government Agent's Division, where the lack of water has led to a high incidence of diarrheal disease and eye and worm troubles.

Situated in the Ampara district, the people of this region are poverty-stricken and depend mainly on "chena" (shifting) cultivation for a living. They are also paddy farmers who grow subsidiary crops such as soya beans, cowpeas, green gram, and maize in the off season.

"The search for water is time-consuming," says Upali Wickremasinghe, a bright young man of 26, who with his 21-year-old wife Indrani, are the field coordinators of the project.

The couple worked on the research project to test the suitability of the Waterloo pump in Sri Lankan conditions. They also carried out a survey on the economic and water situation in the Padiyatalawa area.

This survey helped the organizers to pick the most severely affected villages. It will also be used for comparative purposes once the pumps are installed in Padiyatalawa. □

Mallika Wanigasundara is a Sri Lankan freelance journalist.

AQUACULTURE

HIGH-YIELD VILLAGE PONDS

ANDREW WILLIAMS



Milkfish raised by fish farmers is sold at market, in Iliolo, Philippines.

The practice of raising fish in enclosures as an alternative to capturing them from boats is an ancient one. Pond culture of carp began over 3000 years ago in China and fish farming, or aquaculture, spread from there throughout Asia. The historian Pliny tells us that eels, carp and mullet were stocked in ponds in Republican Rome 2000 years ago.

Aquaculture on a large scale died out in Europe, however, and was carried on in Asia primarily as a sideline by farmers until this century. When Magellan visited the Philippines in the 16th century, he "rediscovered" aquaculture, observing the locals raising milkfish (chanos chanos) in brackish water ponds along the coast.

MORE RELIABLE THAN FISHING

Fish farming offers people the same advantages over fish capture that animal husbandry offered over hunting many years ago. Aquaculture provides a more reliable source of food than fishing does: it can be less expensive, available year-round and less dangerous — as anyone can attest who has seen the small fishing boats of Asia braving the open seas. Despite these advantages fish husbandry has been largely ignored by scientific research until recently and fish farmers were artisans, not technicians.

In this century, the rapid growth in the world's population has resulted in a huge

increase in the need for food protein. Fish is an obvious source to help fill this need, especially in Asia where fish is a major part of the diet. The region has experienced the largest increase in population and also has large expanses of water which could be developed for aquaculture.

Initially, efforts to increase fish production concentrated on marine capture fisheries, and, as was the case with most land-based agriculture, the expansion of fishing areas and improved technology resulted in rapid increases in production during the 1960s and early 1970s. However, it also resulted in a more sophisticated, energy-consuming technology.

Most countries with a fisheries resource to exploit are now developing, or have developed, a deep-water fleet with all the attendant infrastructure of harbours, landing, repair, and processing facilities. Training programs in fisheries gear technology, navigation, and engine operation and repair all have to be established. These are all high capital-cost investments, and with the adoption of the 200-mile economic coastal zone, they should pay dividends.

But the world's oceans are not the inexhaustible resource they were once thought to be. Some experts believe that the maximum sustained yield of the oceans — the point beyond which total fish stocks actually start declining — is now being approached. It is already evident that catch fisheries are

subject to the law of diminishing returns. FAO studies have shown that the cost-per-tonne of catching the last two percent of a school of fish is about 10 times that of the first 98 percent. The energy cost of fishing for the last few percent is equally high, and in the future, marine capture fisheries will likely become even more expensive and energy-consuming. As a source of cheap food for the people of the poor nations, the prospects are not good.

By contrast, the potential for increasing fish production through aquaculture is considerable, and much of the technology is relatively simple and inexpensive. There are also vast underutilized areas of water throughout the Third World that are suitable for aquaculture in one form or another. India alone, for example, has an estimated four million hectares of village ponds, but less than one-eighth of this area is used for aquaculture.

But if the full potential of aquaculture production is to be realized, there is an urgent need for a great deal more research. Until very recently, the only systematic research devoted to aquaculture has been of the capital-intensive variety, aiming for the lucrative luxury markets of the industrialized nations with products such as fresh and frozen trout. This might be useful in bringing in foreign exchange, but it does little to benefit the rural poor.

BREEDING IN CAPTIVITY

Despite the fact that techniques for the artificial breeding of fish through the use of hormone injections were developed over 40 years ago, there still remain many important species that cannot be bred in captivity. It was only in 1977, for example, in an IDRC-supported project in the Philippines, that the milkfish was first bred in captivity. To appreciate the significance of this event, it is necessary to know a little about the milkfish, or "bangus" as it is commonly known in the marketplace.

In the Philippines, Indonesia, and Taiwan, which are the main producers, milkfish is a major source of food protein. With the annual "harvest" running at around 250 000 tonnes, milkfish farming is also of considerable economic importance, especially in rural areas. In the Philippines, for example, it is estimated that some 170 000 families earn at least part of their livelihood from farming milkfish. Until recently, however, it had proved impossible to breed milkfish in captivity. Thus all the fry — the young seed fish required to grow marketable fish — had to be caught in coastal shallows using hand nets. This method is inefficient, as a large number of the tiny fish die during transportation, and is no longer able to meet the growing demands of the industry.

BASIC QUESTIONS

Thus, when the Southeast Asian Fisheries Development Centre (SEAFDEC) launched a project to develop a technology to improve the production of milkfish, mass-

scale seed production was planned. But first, a number of basic questions needed to be answered: How and where do you catch a milkfish breeder alive? Having done so, how do you keep it alive?

SEAFDEC'S seed production team began by capturing wild spawners, but mortality was high. Milkfish are so excitable that capture and handling causes stress that often kills them. A gentle technique for handling and transporting wild spawners had to be developed. The fish were lured into baited cages which were towed to shore. They were then transferred to individual plastic bags and carried on a hammock. When these fish were carefully released into tanks with controlled salinity, a good survival rate was achieved.

The first experiments in 1976, to induce milkfish to spawn, met with partial success. Females injected with purified salmon hormone (gonadotropin) ovulated, but the eggs could not be fertilized since none of the males responded to hormone treatment. In April 1977, however, newspaper headlines throughout the Philippines proclaimed "Bangus is born", "Breakthrough in milkfish culture", and even "Bangus without sex". Spawning had indeed been induced by injecting hormones, namely acetone-dried powdered salmon pituitary gland and human chorionic gonadotropin. The eggs were fertilized with sperm from induced males, incubated, and hatched.

INDUCED FERTILITY

This success, which has since been repeated in other experiments, was made possible through IDRC-funded projects in Canada. The first enabled researchers at the University of British Columbia to demonstrate that the hormone (gonadotropin) released by the pituitary gland to stimulate the gonads is the same in all bony fish. They showed that fertility could be induced in milkfish through injections of gonadotropin extracted from the pituitaries of Pacific salmon. They worked with a commercial fish packer to extract and process the gonadotropin from a million salmon pituitaries, and ship it to various IDRC-supported projects around the world.

More recently, Nancy Sherwood and Brian Harvey at the University of Victoria, and Larry Crim at Memorial University of Newfoundland have followed the hormone chain of command back to the brain. A hormone produced in the brain (leuteinizing hormone-releasing hormone or LHRH) stimulates the pituitary gland to produce gonadotropin which, in turn, stimulates the gonads. Since LHRH is also the same in all species, they began to take the brains, instead of the pituitaries, from Pacific salmon catches.

The latest development will make milkfish breeding independent of B.C. salmon. An analogue (LRH-A) of the hormone produced by the brain (LHRH) is being chemically synthesized. The hormone analogue is longer lasting than the natural LHRH and can be implanted in a time-release capsule



Cage culture reduces the uncertainty of supply that afflicts capture fisheries.

or an osmotic pump to minimize handling of the sensitive milkfish.

The same chemicals are being used in IDRC-aided projects in Malaysia, and in

"There are vast underutilized areas of water throughout the Third World that are suitable for aquaculture."

China where the Chinese carp are being artificially bred in captivity (see companion article, page 29).

The common carp was the most popular species for aquaculture in China for many centuries, until, it is said, there came an

emperor of the Tang Dynasty whose family name was Lee. Since the Chinese word for common carp sounds exactly the same, the mere idea of eating "lee" became unthinkable — so the fish farmers had to turn to other species to fill their ponds. They did not have to look far to find four other carps: the grass, silver, bighead, and mud carps, all of which happen to have quite different feeding habits, and can therefore coexist productively in the same pond. And so the Chinese developed a highly successful fish polyculture system, quite by chance, more than a thousand years ago.

It was only quite recently, however, that the scientific basis of this system was recognized, and in India researchers at the Central Inland Fisheries Research Institute (CIFRI) were quick to adapt the system to India's needs. Using both local and exotic carp species, they developed a polyculture "package" that could produce annual yields of up to 9000 kilos per hectare of pond surface.

POTENTIAL OF POLYCULTURE

Indian fish farmers traditionally cultivate only one species in each pond, and take an annual catch of about half a tonne from a one hectare pond. CIFRI researchers were able to produce more than ten times that amount from the same size of pond by cultivating five or six fish species with different feeding habits under controlled conditions at the Institute's headquarters in Barrackpore.

With the support of an IDRC grant, the Institute sent a team of researchers to relatively remote villages of Orissa, West and North Bengal to put their finding to the test. They wanted to see if the results obtained with composite fish culture (polyculture) under experimental conditions could be duplicated by local people using village ponds.

Biraharekrishnapur Village, close to Puri, Orissa, has three ponds that were originally used for drinking water, personal washing and laundry, in addition to some fish farming. Sri B. Mrisa, the President of the Village Council, says before polyculture was introduced, the value of the fish harvested was about 1000 Rupees (\$125) per year. During 1979, the first year of the polyculture system, the value of the fish harvested from the three ponds was over 22 000 Rupees!

Before stocking, the ponds were cleared of unwanted fish by an interesting locally developed process. They were treated with an oil cake (the residue of an oil seed from which the oil has been extracted) known locally as Mahua. This oil cake contains Mowrin, an alkaloid which is highly toxic to most fish, molluscs and other unwanted pond life. The particular advantage of the process is that the effective toxin undergoes biological degradation within about 10 days.

The ponds were then stocked with the three main Indian carp — Catla, Rohu and Mirgal — and the exotic Silver, Grass and Common Carp. Catla and Silver Carp are surface feeders, Rohu is a column feeder, and the Common Carp and Mirgal are bottom feeders. The ponds were fertilized once a month with cowdung, urea and super-phosphate.

In the Puri area, a farmer allowed his pond to be used to demonstrate polyculture for one year. During that year his cash return from the farm was more than four times what he had realized from the traditional system and he was so impressed with the polyculture system that he is using the entire proceeds of his first year to lease three more ponds and to dig a fourth pond for polyculture.

For all its potential, however, it would be a mistake to assume that aquaculture, no matter how highly developed, can ever solve all the world's food problems. At best, aquaculture production is unlikely to amount to more than a small percentage of the world's total fish production. But it is a very significant percentage. Fish grow



New life: Milkfish larva hatches.

RESERVOIRS FOR HYDRO AND FISH

Artificially created lakes and waterways present another opportunity for substantial increases in fish production. These man-made bodies of water are rapidly being built and expanded to provide hydroelectric power, irrigation and domestic water supplies. If the appropriate techniques could be developed and applied, these artificial waterways could provide fish as well as power and water. In Turkey, IDRC is working with the local government agency to maximize the fisheries potential of the 25-km-long Keban reservoir on the Euphrates River.

The IDRC-assisted project began to study the environment of the reservoir in 1976. Since then it has studied the relationships between different fish species, tested different methods of fish culture such as floating cages, developed a fish disease diagnostic service, and provided training for local staff. Since many fingerlings died during transport from a distant hatchery, IDRC decided in 1983 to help build a hatchery

at the site. The project has encouraged the growth of 14 fishing cooperatives around Lake Keban and the lessons learned here will be applied to two even larger reservoirs now being built downstream.

A similar project was begun in Egypt in 1977. Researchers raised fish in cages in the brackish water of Lake Quarun and in fresh water irrigation canals. Various recipes for pellets to feed the fish were tried using agroindustrial wastes and seem to be cheaper than, and as effective as, fish meal made of imported grain and beans. The second phase of this project began in 1984 and is applying the results of the initial experiments to the High Dam Lake behind the Aswan Dam of the Nile River. The techniques developed here and in other related projects may have wide applicability in many areas of the world. As the demand for hydroelectricity grows, the number of reservoirs grows with it, presenting many areas with a new potential industry and protein source.

fastest in the warm waters of the tropics, and it is here that the need for more food, especially high-quality-protein foods, is greatest.

ECOLOGICALLY SOUND

Aquaculture, properly managed, is an ecologically sound, technologically appropriate means of food production that can provide badly needed additional income to peoples as diverse as Caribbean islanders and Sudanese nomads. But much research remains to be done to bring economical aquaculture within reach of the rural poor in developing countries.

To better understand the magnitude of the opportunity, consider that there are only about 10 farm animals of major economic importance. Yet there are literally thousands of different fish that could possibly be cultured, but about which very little is yet known. Finding out how the best of these thousands of species can be effectively farmed is a challenge of the future for aquaculture researchers as yesterday's art becomes tomorrow's science. □

Andrew Williams, who has written previously for IDRC, is now fund-raising coordinator for the Canadian Organization for Development through Education.

BREAKING THE BREEDING BARRIER

SINO-CANADIAN RESEARCH ON

INDUCED FISH SPAWNING

ZHANG WEIMIN

A new cooperative project between Canadian and Chinese scientists will soon bring a cheaper and more effective means of breeding Chinese carp to fish farmers.

Dr R.E. Peter of the University of Alberta was studying the effects of a hormone produced in the brain, called luteinizing hormone-releasing hormone (LHRH). It causes the pituitary gland to release a second hormone, gonadotropin, necessary for spawning in fish. But injections of this hormone and a synthetic derivative of it (LRH-A) were relatively ineffective in causing goldfish to ovulate.

Further studies in Peter's laboratory identified the problem. A second factor produced in the brain, dopamine, inhibits the release of gonadotropin from the pituitary. In 1982, Peter found that by injecting fish with both LRH-A and drugs that block the effects of dopamine he could induce ovulation in goldfish.

BETTER THAN TRADITIONAL METHOD

When Lin Haoren, chairman of the Biology Department of China's Zhongshan University in Canton, learned about Peter's discovery, he felt that it would provide a far better method of inducing spawning than the traditional method used by Chinese fish farmers. With support from IDRC, Dr Peter and Lin initiated a three-year cooperative project in 1984 to test the method on Chinese carp. So far, Lin said, "we have had positive results in laboratory experiments, and we'll soon begin tests at fish farms."

With a 3000-year history of fish culture, China uses over 10 million hectares of ponds, lakes, reservoirs, canals, rivers and their tributaries, as well as many paddy fields for fish cultivation.

In the temperate and subtropical regions of China, the growth period for cultured fish lasts seven to eight months. In the Yangtze and Pearl river basins fish can be bred continuously throughout the year. In 1984, China produced about 185 million tonnes of fish from freshwater fish culture, the biggest production of cultured freshwater fish in the world. But Chinese fish farmers were faced with the same problem as fish farmers elsewhere. Most of their fish do not breed naturally in captivity. So there had been the continual problem of supplying sufficient numbers of fry and fingerlings for stocking the ponds.

Since 1958 the Chinese have induced



Villagers in central China breed fish in small ponds.

spawning in cultured fish by injecting mature fish with either the human chorionic gonadotropin (HCG) or extracts from the pituitary glands of carp. These techniques have been only partly successful. HCG is effective in only a few species and pituitary extract is very expensive. To induce spawning in a single fish it may be necessary to collect pituitary glands from 10 or more sexually mature carp. Even then many species cannot tolerate the injections and die after ovulation.

Chinese scientists recently introduced a new synthetic hormone, LRH-A, to induce ovulation. Although LRH-A provided a cheaper means of inducing spawning than the use of pituitary extract, it did not always work.

The Chinese had reached the same point in their research as Peter had in Canada. Then Peter found that dopamine, produced in the brain, inhibited the hormones needed for ovulation.

In the first phase of the Sino-Canadian project, Lin and his assistants at Zhongshan University test-injected cultured fish with synthetic LRH-A and pimozone, a dopamine antagonist.

HIGHER OVULATION RATE

"We have done tests on grass carp, common carp, mud carp, loach and bream. The results have shown that injections of

LRH-A alone resulted in increased levels of gonadotropin in the blood, but were relatively ineffective for inducing ovulation. However, injections of LRH-A and pimozone at the same time resulted in a higher rate of occurrence of ovulation," said Lin, who reported his results to a symposium on carp culture in September of this year in France.

With the success of these initial studies, Lin said, the project is moving to search for more effective and cheaper forms of synthetic analogue and dopamine antagonist for use in fish culture.

In Canada, Dr Peter's lab has found a new analogue of salmon LHRH, which has proved to be more active than LRH-A in goldfish. This compound has now been brought to Lin's lab for testing on Chinese carp this year. After the tests, Lin said, "We may find that different kinds of synthetic analogues might be more effective in certain species of fish."

Since the dopamine antagonist (pimozone) now used in tests is not available in large amounts, both Dr. Peter's and Lin's labs are testing a series of alternatives to it. Last year Lin's lab found that reserpine, a drug that blocks the formation of dopamine, had a test record the same as or even better than that of pimozone. A Chinese drug manufacturing company has agreed to produce these chemicals for use on fish farms.

GROWTH HORMONES

Lin's lab also sent portions of the lower brain and the pituitary gland from carp to scientists in the United States and Japan in an attempt to isolate other hormones that may effect growth. "In the future, it may be possible to use hormones to influence the growth of fish much in the way we have been using hormones to influence ovulation," said Dr G. Van Der Kraak (from Dr Peter's lab), who came to China early this year to help Lin with the second stage of the experiments.

Lin said, "If we did not get the information and equipment from the Canadians, it would be very difficult for us to do the experiments."

"We also have obtained benefits from the experiments conducted in China," commented Dr Van Der Kraak. "The experimental results obtained from Professor Lin's laboratory have influenced the types of experiments we conduct in Canada, and may soon influence scientists studying fish reproduction throughout the world." □

Zhang Weimin writes for China Features.

BEYOND BASIC LITERACY

A UNIVERSITY FOR THE RURAL POOR

GERRY TOOMEY



Rural University agent (right) meets with co-op store members.

The educational goals proposed for rural peoples in developing countries do not usually extend beyond basic literacy and the technical skills. The Foundation for the Application and Teaching of the Sciences (FUNDAEC) near Cali, Colombia was established in 1974 as a rural university to go beyond these limited goals and to bring the benefits of higher learning and scientific and agricultural research to the rural poor of the surrounding Cauca Valley.

FUNDAEC was the brainchild of a group of university professors from the Universidad del Valle who became aware that development was not improving the lot of the majority of poor Colombians. In particular, the new agricultural technologies of the "green revolution" had permitted the large plantation owners to increase their yields, and thus profits, and to acquire the lands of many smallholders.

FARMERS BECAME LABOURERS

The large plantations were increasingly given over to the production of export crops such as cotton, soybeans, and especially sugarcane. The landless farmers were forced to become labourers on land that may originally have belonged to their families or to search for temporary work in nearby cities. Development has not only failed to improve the lot of the majority of small farmers in Cauca, it has actually worsened their situation.

The impetus for establishing FUNDAEC was disappointment with traditional rural education and awareness of the increasing poverty confronting the rural population. The rural university sought to do more than teach farmers to use technology brought in from outside; it tried to develop trained individuals who could both identify the problems of the community, and research strategies to address them. "Usually when one thinks of institutions working with peasants, they are not supposed to take a very high-

powered approach intellectually," says FUNDAEC director Dr Farzam Arbab. "What is usually taken to the peasants is information, not knowledge. As far as I can tell, FUNDAEC is a rare kind of institution because we make the creation of knowledge the basic issue. A rural population needs a university, not just primary or technical schools, to act as its learning institution."

"I think we've broken the myth that getting an education automatically means leaving the rural areas."

The three levels of the FUNDAEC learning system are the "promoter" of rural well-being, the "technician," and the "engineer." The promoter level is the basic two years of high school education FUNDAEC hopes will become universal in the region. The technician level is achieved by continuing one's studies two years past the promoter level, to the equivalent of completion of high school. After an additional three years' study, the student attains the "engineer" level, equivalent to graduating from university.

Many people believe that education contributes to development by providing individuals with specific skills and knowledge; they assume that somehow the existence of such individuals will by itself bring about development. FUNDAEC, on the other hand, considers its main objective to be the search for development strategies for the region it serves. Training programs, the

nature of which must necessarily change over time, are only components of the overall strategy.

The students work both as teachers of the farmers and as consultants with small-scale production ventures involving up to six farmers. This ties part of their salary to the profits of the associations, ensuring their commitment to them and giving them a source of income. In addition to this role, the engineers of rural well-being are engaged in agricultural research and in bringing literacy and the benefits of the research to the peasants, using materials developed by FUNDAEC.

FUNDAEC's professors feel the curriculum, especially the service to the community component, has engendered a strong sense of commitment among the new engineers for rural well-being. Not everyone has been so optimistic. "Many people made bets with me that none of them would be there after the first couple of years," recounts Dr Arbab. "It's turned out to be totally the opposite. I think we've broken the myth that getting an education automatically means leaving the rural areas."

While FUNDAEC goes on training promoters, technicians, and engineers, perfecting its curriculum, and finding technological solutions to villagers' problems, a nagging question remains. How far can people develop with such limited resources? Rural development where there is no land available to the farmers, says Dr Arbab, is meaningless.

The pattern of land tenure is unfavourable to the villagers of the region. But the correction of such a structural problem is beyond the ken of the rural university, which is nonpolitical. Perhaps FUNDAEC's contribution to Colombia's development is that it is providing the people of the Cauca Valley a way of improving their daily lives, however modestly and slowly, without resorting to violence or revolution. □

INSIDER OUTSIDER

THE PEASANT AND THE SCIENTIST

FARZAM ARBAB



Mutual benefit: The farmer and researcher learn from each other.

on specific economic projects have been led to a much broader set of problems. It is not that economics loses importance as one tries to look at development from inside a rural population. In fact, problems of social injustice are actually felt with far more intensity, and production continues to be a very important concern. But the dominant concept becomes that of the human being and the processes of human life, which include economic activities along with other pursuits of family and community life. As outsiders become more and more involved with peasant populations, they become aware of a whole set of interrelated issues concerned with knowledge. Development workers find that they contribute to the application of advanced science and technology only within the context of the attitudes, skills, capabilities and social organization of the rural peoples themselves.

The changing moral and ethical value systems in developing countries are inadequate to cope with accelerated change. This is not merely a matter of political and bureaucratic corruption. At every level the beliefs, concepts and norms that define relationships between individuals and the society within which they live are in crisis.

CONFUSION OVER VALUES

In both rural villages and the slums of the cities, people are bombarded with images of foreign lifestyles. People are confused about their old value systems and have a strong desire for a new and more comfortable life. This creates a combination of want and hopelessness, a condition not conducive to creative change. Even among the ruling classes who have attained the benefits of modern life, basic trust, respect, and compassion are disappearing. The vitality of hopefulness is constantly diminishing.

The old concepts of class struggle and the old solutions of training programs do not lead to creative plans for positive change. Attitudes towards rationality, efficiency, work and problem-solving as well as approaches to family life and community solidarity need to be studied.

There must be created, within developing countries themselves, the capacity to analyze changes in moral and ethical structures so that both national policy and specific projects can be placed in the real context of human and social development.

SCIENCE, TECHNOLOGY, AND EDUCATION

A second set of problems has to do with our basic inability to induce accelerated but constructive change in the scientific and technological culture of most developing societies. It seems that development projects, when successful, can transfer elements from modern science or technology to certain groups within developing countries. This transfer may involve the development of universities and research institutes or simply the adoption of single technological packages by a peasant family.

It is becoming more and more clear

"The changing moral and ethical value systems in developing countries are inadequate to cope with accelerated change."

national product. As this failed to achieve the desired end, windows were opened to look at some of the constraints. In the 1960s, development programs also became concerned with such bottlenecks to progress as population and backward traditional agriculture.

Later, new windows were opened to look at services such as health and education, or even at such touchy questions as the distribution of wealth. It is not clear, of course, how long it will take for this outsider's view to embrace the entire complex set of factors that affect development. It is even less clear if it will ever lead to participation with people in their own path of development.

Independent of their initial ideology, many of the individuals and groups who have worked closely with rural populations

Development, as a global effort to end poverty in the world, has not enjoyed outstanding success during the past three decades. Its failures have led those concerned with social change to look more closely at the assumptions behind accepted theories. As a result, a gradual shift has occurred in the pattern of thinking about development.

Today, people no longer think that capital investment, accompanied by transfers of Western technology and know-how, will immediately result in development. Analyses of development now tend to include such factors as social justice, redistribution of wealth, local participation, the role of bureaucracy, political processes, the international economic order and the endangered ecology and apparently dwindling resources of the planet.

Recently, the term "people-centered development" has appeared in the literature with increasing frequency. It is ironic that it should be considered so important to introduce such a term explicitly into the discussion. What other kind of development, one may ask, was being contemplated for the rest of the world during the past thirty years? The sad fact, however, is that it is difficult to find "the people" in the hundreds of plans that have followed the evolution of thought in mainstream development. Under both dominant political ideologies, people are rarely considered except as factors that affect other systems and processes.

OUTSIDER'S VIEW

Obsessed with economic growth as the only meaningful development process, planners often seem to have treated developing countries as a black box. Small windows are opened to look inside the box only when one's interventions begin to fail.

The first simple model was to introduce capital and Western know-how into the box, and measure the output as the gross

however, that sustainable development involves creating with a people a path of change, which can benefit from other cultures, but which will have to be trodden by the people themselves.

The capacity to analyze and understand the dynamics of scientific and technological cultures, and to manage the corresponding processes of change, has to be strengthened in the developing world. This must include the ability to bring together the discourse of the different groups in science, technology, and education, and must create mechanisms through which new understanding can influence the direction of policy.

PERCEPTIONS

In spite of more than a decade of debate on appropriate technology, there is little "certain" knowledge that can be used in determining strategy. What is the nature of the technology that will allow the rural inhabitants of a given region to change a disintegrating subsistence economy into a viable alternative, a rural one that enjoys the benefits of modern society? Is there really a technological choice or is technology basically determined by political conditions and by economic policy?

The experiences of the past three decades have shown that along with technology, many of the accepted views on science and its methods need to be re-examined. It has become clear by now that the distinction between modern Western science as truth, and the traditions of other people as a mixture of superstition, common sense, and unstructured wisdom is to be abandoned.

We must now learn how to handle the tensions that arise between modern science and the local traditions of a region. This implies finding ways of recuperating traditional knowledge and validating it, in adapting quantitative methods to the realities of specific populations, in developing valid qualitative methods of inquiry, and in discovering an adequate language to express the results of scientific research so as to open the door to the participation of the people in search for solutions to their own technological problems. It also implies a closer look at the structure of the present day disciplines and the creation of mechanisms that allow knowledge as a whole, and not merely its fragments, to be brought to bear on the urgent needs of developing towns and villages.

GENERATION AND APPLICATION

In the past, technological packages have been developed by experts and handed out to beneficiaries through extension. Many of these programs have failed because of the lack of sensitivity to the real problems of the community and the way their members perceive the world around them.

Parallel to and in collaboration with institutional efforts to push forward the frontiers of the agricultural and biological sciences, high quality research has to be done at the

level of specific rural areas in order to generate the necessary technology for production on small farms. Such research must bring together social inquiry and technological development, and ensure the participation of the villagers themselves in the generation and application of knowledge. Through this research, systems of production have to be developed that offer significant improvement over the traditional systems on the one hand and the modern mechanized monoculture on the other. This implies a program for the selection of species and varieties for systems that are based on diversity of crops and animals.

A more relevant process of technology production in itself needs to be closely connected with a sound educational process. Many of the past difficulties of development efforts can be attributed to the limitations of a fragmented research-development-extension system. On the one hand, research is needed to clarify the possible role of education in bringing about change in the scientific and technological culture of a people. What are the possible



Learning to grow better beans in Colombia.

contents of educational systems that would help modernize without destroying the past and forcing the vast majority to live at the margin of society? What are the possible roles of formal and non-formal education? What is the role of extension and can it be integrated more closely with education? On the other hand, there is a great need to promote educational innovation in rural areas, to systematize the lessons learned from such innovations, and, on the basis of systematic experience, to influence the content and the methods of formal educational systems.

ORGANIZATIONS AND STRUCTURES

In rural areas, the old village structures and organizations are crumbling under the often disintegrating forces of modernization, but the structures of the modern village are not there to replace them. Actual data are finally showing that local organizations merit a far more central role in development schemes.

All the processes of rural life, production, simple manufacturing and repair, market-

ing, the development of human resources, socialization, the flow of information, the maintenance of health and sanitation, decision making, and many others, are in need of basic structures that can be connected to the corresponding structures of the social, economic, cultural, and political life of the nation as a whole. It is indispensable to create and strengthen the capacity in developing countries to carry out valuable research in social organization, to promote innovative village structures, and to influence the political environment of most countries so that effective local institutions may actually begin to emerge.

INSTITUTIONS OF RESEARCH

Learning about development is, in the final analysis, only achieved through action; research has to be carried out in the context of actual development programs in a country or a region. Which are the institutions in the Third World that would carry out research in the subject areas suggested here?

On the one hand, more than three decades of development action by international agricultural research centres and governments aided by universities and specialized institutions have taught us a great deal about policy, the design of large-scale programs, the behaviour of bureaucracies in administering these programs, and the effects of different economic and political forces that influence a given plan.

On the other hand, the past two decades have seen the emergence of a large number of intermediate size private institutions sprung from universities, political groups, and churches. These smaller institutions combine reasonable scientific capability with the flexibility of a small group immersed in the problems of specific rural or urban populations. While most of these institutions enjoy little access to power to accomplish significant development objectives, they have certainly generated a great deal of valuable knowledge about strategies of change and have been far more effective in their own small spheres of influence than most large projects.

The strength of these intermediate institutions has actually been recognized by large bilateral and multilateral donors. But to incorporate them in their plans, always tied to bureaucratic regulations, has proved to be next to impossible. It is essential then that much more systematic thought be given to the role of these intermediate size institutions, that their support be greatly increased, and that somehow their experience and efforts be integrated into the larger programs with greater possible impact. The institutional arrangement appropriate for future research in agriculture and rural development is exactly the combination of large official institutions and those intermediate size organizations which possess scientific capabilities yet have strong and intimate connections with specific rural populations. □

Farzam Arbab is president of the Foundation for the Application and Teaching of Science in Colombia. He is currently Visiting Scholar at the Harvard Institute for Development.

WHAT IS IDRC?

The International Development Research Centre (IDRC) is a corporation created by the Parliament of Canada in 1970 to stimulate and support scientific and technical research by developing countries for their own benefit.

The fields of investigation to which IDRC gives its financial and professional support affect — directly or indirectly — the day-to-day lives of people in the developing world. These areas include: farming; food storage, processing, and distribution; forestry; fisheries; animal sciences; energy; tropical diseases; water supplies; health services; education; population studies; economics; communications; urban policies; science and technology policy; and information systems.

Although IDRC is funded entirely by the Canadian Parliament, to which it reports annually, its operations are guided by an international 21-member Board of Governors. Under the IDRC Act, the chairman, the vice-chairman, and nine other governors must be Canadian citizens; in practice, 6 of the remaining 10 governors are from developing countries.

Who benefits?

Three-quarters of the population of the developing countries live in rural areas. These people are usually the last to benefit from the advances of science and technology and it is to them and to the betterment of the quality of their lives that most IDRC-funded projects are directed. Some support, however, goes to research on the problems of urbanization, particularly rural-urban migration, housing, and sanitation technology for squatter settlements.

The IDRC approach

IDRC emphasizes the role of the scientist in international development and encourages Third World countries to draw on the talent of their own scientific communities. Building a strong local base for future research is an important



objective of most Centre-supported work.

Research projects supported by the Centre are identified, designed, conducted, and managed by developing-country researchers in their own countries, to meet their own priorities.

IDRC helps to create and supports international research networks through which developing countries can learn from each other, share common experiences, and conduct similarly designed studies in areas of mutual concern.

The Centre also promotes cooperation between developing-country researchers and their counterparts in Canada.

Research Programs

Agriculture, Food and Nutrition Sciences Division — In this group of related sciences, emphasis is on crops, farming systems, and afforestation in arid and semi-arid lands. Other major areas of support include: previously neglected food sources such as root crops, food legumes, and oilseeds; agroforestry

(growing trees and crops together); multiple cropping systems; improvement of pasture lands; use of agricultural wastes and by-products in animal feed; artisanal fisheries and fish and shellfish farming; post-production systems for the protection, processing, and distribution of food crops, fruit, and fish; and the needs of the rural homemaker and family.

Health Sciences Division — The division's support is concentrated in applied research in five broad program areas: water supply and sanitation; maternal and child health; tropical and infectious diseases; occupational and environmental health; and health operations research. The latter involves every facet of health systems research such as the training of personnel and health economics.

Social Sciences Division — Research supported by the division is designed to improve understanding of the social and economic issues related to international development, permitting researchers and policymakers to formulate policy options in several thematic areas. These include: education, population, science and technology, energy, urban development, economics, and rural development. Support is also given to a limited number of national and regional institutions in the social sciences, and to research on problems of special regional concern.

Energy — The worldwide effects of unstable energy supplies and prices in recent years have underlined the urgent need for increased research on the energy problems of those most adversely affected — the developing countries. One of IDRC's major activities in this area has been the coordination of an international Energy Research Group comprised of 10 energy analysts and policymakers from developing countries. Funded jointly by IDRC and the United Nations University in Tokyo, the Group is working to identify energy research priorities for developing countries and to suggest how national, regional, and international research resources can be better allocated.

Information Programs

Information Sciences Division — Support given by the division helps developing countries to: establish regional and national information systems and improve library infrastructures at these levels; participate in international information networks; create specialized information centres (serving the region or world) on development-related subjects, especially in agriculture, health, population, industry, the environment, cartography, and social issues; and develop information tools and methods. The division's computer systems group provides internal services and distributes MINISIS, a software package designed by IDRC, to developing countries. In addition, a library and micrographics unit serve IDRC staff, the Canadian development community, and IDRC-supported projects.

Communications Division — Services provided by the division include: the publication and dissemination of the results of IDRC-supported research via print and film media; public affairs; and translation. The division also supports projects aimed at strengthening the ability of research institutions and communications media in developing countries to prepare and disseminate scientific and technological information.

Collaborative Programs

Cooperative Programs Division — The division promotes collaboration between scientific research groups in developing countries and their counterparts in Canada — whether academic, governmental, or private. The first area of specialization created was the Earth Sciences program. By establishing channels of communication among scientists, the division helps improve the transfer of research results from Canada to the Third World. Project support is open to all disciplines that contribute to Third World economic or social development and in which there is recognized Canadian expertise. It is important, however, that the developing-country research



IDRC's work is guided by an international Board of Governors.

"The objects of the Centre are to initiate, encourage, support and conduct research into the problems of the developing regions of the world and into the means for applying and adapting scientific, technical and other knowledge to the economic and social advancement of those regions . . ."

*Section 4.(1)
International Development
Research Centre Act,
May 13, 1970*

group play a significant role in formulating a scientifically sound project proposal and in planning and executing the project, thereby strengthening its research capacity.

Fellowships and Awards Division

— The division provides support to train junior and senior Third World scientists, managers, and planners working in sectors covered by IDRC's program divisions. The emphasis is on support to individuals from the least developed countries and on professional upgrading rather than basic training. In addition, the division supports non-degree group training to improve technical, research, and administrative skills of individuals through practical courses. A portion of the division's funds is also used to encourage the involvement of young Canadian researchers in scientific areas of concern to IDRC, and to expose them to the problems of the developing world. These doctoral students are posted to a Third World country for studies, research, or placement.

For more information . . .

IDRC's Communications Division produces a number of publications for the general reader, such as this quarterly magazine, *IDRC Reports*, and *Searching*, the annual review. In addition, the Centre publishes scientific monographs, technical studies, proceedings of meetings, bibliographies, and booklets for policymakers. Films describing the Centre and some of the areas of scientific research it supports are also available. Briefings for interested groups or individuals can be arranged on request.

For further information, contact IDRC at the following address: (or any of the other addresses listed on page 3):

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FROM SUBSISTENCE TO THE SUPERMARKET:

SWEET POTATOES GO COMMERCIAL

PAUL M. ICAMINA

A common backyard plant and staple food in most Philippine communities, different varieties of the sweet potato are named after witches, fairies, time, people, colours, animals and plants. But most of the country calls the sweet potato simply the "camote".

It is truly the food of the masses, a staple in many villages, a reliable crop in times of drought and typhoons. The unpretentious roots of this crawling vine plant are the staff of life for many impoverished communities.

Sweet potato (*Ipomea batatas*) is, literally, a "lowly" plant that grows close to the ground and thrives in poor soils. To eat sweet potatoes is also to be "poor" as it is a food associated with the diets of the poor. Whether it is failure of an arithmetic quiz or the current economic squeeze, Filipinos have a word for it: "nangangamote", roughly "to go sweet potatoes". "Go home and plant camote (sweet potato)" is another common expression — when all else fails and there is nothing to do but, well, plant camote.

"TO SEE IS TO BELIEVE"

But all of a sudden, the lowly camote is tempting the national imagination. Juan Trivinio, a former governor and congressman who owns more than 700 hectares of sugar plantation, plans to expand his 25-hectare sweet potato farm. "I'd be crazy to plant sweet potatoes," he said, "if I didn't expect to make a profit."

"To see is to believe, is what my skeptical neighbours told me," recalls tenant farmer, Serapin Oracin, of Igang Village. "They saw my harvest and now they believe."

Sweet potato breeding started in the Philippines in the 1920s but until 1983 only one variety was ever developed. But now farmers are excited about three improved varieties (VSP-1, VSP-2 and VSP-3) that have shortened planting-to-harvest time and more than doubled the yield.

VSP-1 is a relatively moist variety that retains its orange colour when cooked and yields an average of about 21 tonnes per hectare. Its moisture, colour and taste are all comparable to varieties preferred by the American consumer, making it an attractive export crop. VSP-2 has similar protein content (3-6 percent dry basis), is slightly drier and has a purple tinge. VSP 1 and 2 are more upright, bushy plants than the traditional vines, making the roots easier to find in a single harvest. There is no need to lift

the vines during weeding and cultivation and if they are intercropped with taller plants like sugar cane or cassava, they do not climb the main crop. VSP-3 is a dry (40 percent dry matter), mealy, yellow potato, making it the variety most preferred by locals. Since the sweet potato is a staple food, the higher protein content (7-10 percent dry basis) should improve the protein balance, particularly of the diet of poor people. VSP-3 yields about 17.3 tonnes per hectare under experimental conditions and grows like the traditional crawling vine preferred by subsistence farmers who harvest progressively, returning several times to get the largest roots.

Traditional varieties of sweet potato yield between four and seven tonnes per hectare in the field. Under experimental conditions the new varieties yield an average of close to 20 tonnes per hectare and give net returns better than that from rice, white corn or cotton.

Traditional varieties have a growing season of five to seven months, depending on the local climate but the new potatoes can be harvested after only three to five months in the same areas. "Before the early varieties of rice came, we planted only once a year," explains a farmer's wife. "Now with the new rice varieties, we harvest three times a year. So it is with the improved varieties of sweet potatoes."

"The new varieties are a milestone in the development of the root crop industry in the Philippines", says Dr E.N. Bernardo, director of the Philippine Root Crop Research and Training Centre (PRCRTC). "The work of Dr Saladaga has initiated a

change in the status of sweet potatoes from a poor man's food grown at subsistence levels to a valuable commodity." Dr Florencio Saladaga, head of the plant breeding program at Visayas State College of Agriculture (VISCA), did much of the selection and breeding of the new varieties. The research was financed jointly by PRCRTC and IDRC.

Not only have the new varieties been a boon to commercial producers, they have also improved the lives of small-scale and subsistence farmers. Segundio Peseral says he is producing more than enough. "After I sell, there is still enough left for our food as well." The governor of nearby Southern Leyte province says that after last year's typhoon, the new varieties "helped prevent famine".

Sweet potato research started at VISCA in 1975. Researchers collected plants from all over the country and bred pairs of different types. These biparental crosses imply that two plants can produce only the combinations of the traits of two genotypes in a growing season.

SIX PROMISING LINES

Dr Saladaga used polycross hybridization for the first time in the Philippines. Selected parents were grown in a nursery and allowed to all breed together. Thousands of combinations were produced. Batches of the offspring were subjected to various phases of screening and selection. At this point, instead of studying each plant in the laboratory for the desired characteristics, Saladaga visually selected the most promising plants which were then analyzed and tested in preliminary yield trials. The six most promising lines were entered in regional trials across the country.

The new varieties were produced in two years, from 1981 when polycross breeding was first used, to 1983 when the varieties were recommended by the Philippine Seed Board. The three VSP varieties were chosen from 8200 plant genotypes for their high yield, low moisture content, high protein content, resistance to insects and disease, storability and acceptability to consumers.

Dr Saladaga attributes the research success to the cooperation of all the members of the team which included a plant breeder, cytogeneticist, plant physiologist, pathologist, entomologist, biochemist, economist and agronomist.

VISCA's campus, the centre of sweet potato research, is in the Leyte province,



Photos by Paul Icamina

"The farmer will get the best price if he sells the raw tuber as food."

They are hardy and easy to grow but Mr Travinio, who farms on a large commercial scale, says "the problem with sweet potatoes has always been marketing." With the potential for increased yield and quality of the new varieties, sweet potatoes are becoming attractive to commercial producers. Like many sugar producers, Mr Travinio would like to convert some of his estates from cane to potatoes because the sugar industry, he notes, is in dire straits. He is investigating a process which makes animal feed from sweet potatoes and recently visited VISCA to see the pilot feed mill there which also processes cassava.

Another recent visitor to the mill at VISCA was the president of a Dutch grain company. He says his company could sell 30 000 to 40 000 tonnes of dried sweet potatoes per month if regular supplies and standard quality could be guaranteed. He estimates that the compound feed industry of the European Economic Community countries could use up to two million tonnes per year of sliced or pelleted sweet potatoes. These countries import about 30 million tonnes of feed ingredients each year. China is currently the lone supplier of dried and sliced sweet potatoes to the EEC and its shipments are irregular because it consumes most of its produce locally.

The Philippines is also encouraging root crop production in order to substitute for or supplement imported feed. The "Sweet Potato Feed Program" aims at establishing 20 000 hectares of sweet potatoes, yielding 800 000 tonnes of roots per year. This would replace about US\$28 million of imported yellow corn in hog and beef rations.

But studies by VISCA on the marketability and profitability of sweet potato show that

it is too costly for animal feed. Using sweet potato as feed is recommended only when the market price is very low or surplus production will result in storage loss. They note that finishing hogs and layer ducks perform well on ration in which potatoes are incorporated, but the farmer makes more profit if he sells the sweet potato as chips instead of

animal feed. The farmer will get the best price if he sells the raw tuber as food.

SOURCE OF VITAMINS, MINERALS

One study warns that increased production encouraged by the new varieties might dampen prices, indicating the importance of increasing demand in the local market through small-scale processing. Sweet potatoes can be boiled, baked, fried or steamed. Even the leaves and tops can be cooked as a vegetable dish. The roots can be sweetened to make candy, fried like french fries or dried as chips or cubes. It

A GIFT FROM THE MAYANS

The sweet potato is not a relative of the white potato (*Solanum tuberosum*) but belongs to the family Convolvulaceae of which there are about 50 genera and over 1200 species grown from sea level to about 2500 metres above sea level in most tropical and subtropical areas.

They have been cultivated since about 3000 B.C., and were an important food for the Mayans in Central America and the Peruvians in the Andes. By the time of America's "discovery", they had spread to Mexico and the West Indies. Spanish explorers carried the roots to Spain, Africa, to the Philippines and the East Indies from where Portuguese explorers carried them to India and Malaya. According to one historian, Fukien sailors in 1594 carried the sweet potato roots from Luzon Island in the Philippines to South China, from where they spread to Taiwan and to Japan. Exactly how they got to Polynesia, nobody knows, but European explorers found the plants already an important food in New Zealand, Tahiti, Hawaii and Easter Islands.

Today, sweet potatoes are the most important vegetable consumed in the Philippines next only to rice and corn as the most important staple food. In 1974-76, the national per capita consumption was 11 kilograms per year, more than double that of any other single vegetable.

is a good source of provitamin A (carotene), vitamin C, vitamin B, calcium, iron, potassium and sodium.

Tropical root crops are not generally stored after harvest on a large scale except in industrialized countries, so little information on traditional methods is available. IDRC is funding research on root crop storage which is currently identifying storage microorganisms which promote decay. The research is also looking into appropriate storage for root crops like cassava and sweet potato.

an island beset by typhoons, insurgency problems, snail fever (schistosomiasis), landlessness and poverty. Here, sweet potatoes and cassava are the main supplementary staples, mostly planted in remote, un-irrigated, mountainous areas. In the Eastern Philippines (Samar and Leyte provinces) people consume an average of 31.8 kilos of sweet potatoes per year, compared with a regional low of 2.9 kilos in the Southern Tagalog Region. Although families generally cultivate other root crops as well, almost everyone raises cassava and sweet potatoes. Most families (95 percent) use the roots as staple food or cereal substitute especially when corn or rice harvests are poor. Peelings and roots unfit for food are mixed with other waste vegetables as feed for swine. More than half of sweet potato farmers are share tenants cultivating an average area of less than half a hectare.

Already the new varieties are on sale in



Snacks made from VSP varieties of camote are fun and tasty.

some markets of Leyte. Dr Saladaga has sent cuttings to 11 of the 12 regions of the country. In Eastern Visayas alone, over 1.8 million cuttings of the new varieties were given to over 1200 farmers who, in turn, have sold or given cuttings to neighbours. The varieties were also given to evacuees after the 1984 eruption of Mt. Mayon and cuttings are distributed through the government's Typhoon Rehabilitation Program. "The advantage of the sweet potato is that it is safe even if typhoons come every year," says Mr Travinio, an early VSP enthusiast whose cuttings have been distributed to typhoon victims throughout the country.

Sprouting is a major problem in storage since it is followed by weight loss and rapid deterioration. Chemical treatments, refrigeration and gamma irradiation are expensive solutions, so researchers have turned to the effect of diffused light which has been found to suppress sprout growth.

Storing roots in a hut with slatted bamboo walls and closed bamboo flooring reduced sprouting of VSP-3 roots at the research station by 99 percent. Trials in the field show that, after 90 days of storage, damage was reduced from 30 percent to 5 or 10 percent. This was the first time that farmers had stored the crop for so long because traditional varieties deteriorate rapidly and produce an unpleasant odour. Another first is the use of bamboo water troughs in storage huts to increase humidity and improve storage. Weevil infestation is reduced or prevented by visual inspection of roots prior to storage.

BENEFITS OF STORAGE

Farmers who are encouraged to modify existing structures to minimize extra costs now see the advantage of storage when prices are down. Preliminary findings of a study on the impact of storage technology show that length of storage depends on farmers' needs for food or cash or on the deterioration of the stored roots. Previously, farmers tended to delay sweet potato harvest if prices were low and to dig the roots as they were demanded for sale or home consumption. Now farmers are beginning to see that by harvesting the whole crop at once and adopting storage technologies, their fields can be planted to other crops immediately after harvest.

"Some villagers are more adaptive to the new varieties and technologies than others," says Dr Emma Post, project leader for post-harvest studies. "Short of being detrimental to sweet potato yield, we leave farmers to their own methods of cultivation and storage so as not to arouse any hesitancy in adapting the new varieties."

NO HESITANCY

Serapin Oracion has no hesitancy — he is now on his third cropping of the new varieties of sweet potatoes. He is a share tenant who gives one quarter of the produce he gets from his hectare of coconut farm lots to his landlord. He rotates sweet potato cultivation with peanuts, cassava, and corn, planting the crops under rows of coconut trees. Like most villagers in this part of the country, where the sweet potato is a staple food, Mr Oracion considers VSP-1 too wet and sweet for local tastes. He prefers to plant the drier VSP-2 and 3 and other varieties that are being field tested but which are not yet certified by the Philippine Seed Board.

Already, Dr Saladaga's research team is field testing several promising new breeding lines. One such breeding line (VISCA 7-27) will be nominated for release as a new variety, possibly to be named VSP-4. □



Pilot feed mill for cassava and sweet potato.

“DELICIOUS SWEET POTATO”

Researchers are investigating sweet potato pulp residue as a source of pectin for the food industry. Sweet potatoes can be fermented to make vinegar or wine. Dehydrated and sweetened, they are comparable to similar mango products, the orange colour of VSP-1 tempting to the appetite. Sweet potatoes can substitute for wheat flour in making soy sauce and can be used up to 20 percent in buns and cakes, 40 percent in loaf bread and 50 percent in crackers.

A metal slicer with a cutting capacity of 22 kilograms per hour has been developed specifically for a new product called “Delicious Sweet Potato”. VISCA

has developed a low-cost dicer from locally available materials and a charcoal burning attachment for solar dryers to make them more dependable.

A fashionable research area in recent years in the processing of sweet potatoes into fuel alcohol. With a shorter crop cycle (4 months) against that of cassava (8 months), sweet potato is a promising fuel source. “However commercialization in the immediate future is not feasible because of the high production cost and undesirable competition with its use as food,” says Truong Van Den, the Vietnamese study leader for biochemical studies.

KING OF CAMOTE

PROFILE OF DR F.A. SALADAGA

PAUL M. ICAMINA



Dr Florencio Saladaga

As a boy of 15, he used to cut sugar cane eight hours a day, saving what he could from the 1.75 pesos he earned each grueling day in the late 1950s. Today at 41 years old, the *sacada* (migrant worker) is a plant breeder, and his sweet potatoes are sweet music to some farmers in a sugar industry which has turned sour.

Dr Florencio A. Saladaga has been going places since coming out of elementary school with honours. He has visited Papua New Guinea and Taiwan, far from his birthplace of Tabogon, Cebu Island, Central Philippines. First he quarried stone for an international airport in Mactan Island, then cut sugar cane on another island, finally hopping over to Leyte Island to study in what was then the Baybay National Agricultural School. Dr Saladaga recalls: "I only wanted to finish secondary school as my family was poor. In fact I was the first child to be in college." The school has since been renamed Visayas State College of Agriculture (VISCA) and Saladaga is in charge of the country's sweet potato research which is centred there.

Supported partly by his income from working in the school's ricefields, Dr Saladaga completed his studies at the agricultural school and promptly got a scholarship at the University of the Philippines - Los Banos. Upon graduating there, he was immediately appointed a teaching fellow and was later granted a scholarship for an M.S., which he got in 1973.

COMMITMENT TO COMMUNITY

He then worked at the International Rice Research Institute (IRRI) studying the efficiency of fertilizers and pesticides in flooded rice land. In 1975 he returned to VISCA as assistant professor and chairman of its Department of Plant Breeding and Agricultural Botany. He was awarded a scholarship by IDRC to pursue his Ph.D. in plant breeding at Louisiana State University, Baton Rouge, United States, from 1978-80.

"I came home because I had a commitment to my community," Dr Saladaga says. He could have easily stayed in the U.S.A. and become another brain-drain statistic — his children were already enrolled in school and his wife had just been awarded a doctorate in education from the same university. They went home when Fe Saladaga was eight months pregnant; if they had stayed a little longer, their child would have been an American citizen. "We didn't want to have two kinds of citizenship in the family," he says.

And so it was back to Baybay, Leyte, where Dr Saladaga worked wonders on the poor man's crop, the sweet potato. It was while studying in the U.S.A. that he learned the technique of polycross breeding. In fact he assisted the university's evaluation of sweet potato breeding lines, one of which was released as a new variety in the U.S.A. in 1980.

Dr Saladaga remembers how folks back home used to laugh when they heard that he went all the way to the U.S.A. to study sweet potatoes. Actually, Dr Saladaga's love affair with sweet potatoes started a long way back, in his hometown. He grew up in a region whose staple foods are corn and root crops, a peculiar diet in a rice eating country. Corn is the staple food in his home province of Cebu. "I never tasted rice until I was in high school," Dr Saladaga says. "Always at home it was corn and sweet potato and corn. Today I still prefer corn to rice. While working as a student farmer in high school, the share of rice we got from the school farm we would sell to buy corn grits for our meals."

STARTED ROOT CROP COLLECTION

Upon returning to VISCA in 1975, he led a task force that defined the status of research and research needs for root crops and vegetables. He then scoured the country for promising root crops, including sweet potatoes, and started an extensive root crop collection. For a while he also headed VISCA's coconut breeding program. Since 1981, Dr Saladaga has been in charge of the national program for the varietal im-

provement of sweet potatoes and since 1982, he has been vice-chairman of the Philippine Seed Board Root Crop Varietal Improvement Group.

In 1983, the Crop Science Society of the Philippines chose his study on sweet potatoes as the year's best research paper. The following year, he was awarded the Presidential Medal of Merit and this year, he is nominated for the "Donald Plucknett Research Achievement Award for Tropical Root Crops". He is being cited for a "most significant contribution", the development of three sweet potato varieties (called VSP) and a few advanced lines now in the final stage of regional testing for consideration by the Philippine Seed Board. Among his achievements cited is the "impressive" collection of sweet potato, cassava and yam cultivars (cultivated varieties) many of which he evaluated in 1975-77 despite limited funds.

The provincial government of Camiguin Island in Southern Philippines has passed a resolution expressing gratitude to VISCA for the free sweet potato cuttings sent to typhoon victims. But the best compliment he has received so far was while on an official trip in the Bicol provinces. One farmer asked him if he had heard of the "Trivinio camote (sweet potato)" with its big fleshy roots and bountiful harvest. The said sweet potato was actually one of the new VSP varieties popularized in the area by an enterprising gentleman-farmer.

CUSTOMERS FROM AFAR

Dr Saladaga walks through a market in the port city of Ormoc. He points to VSP varieties on sale, pinches the flesh of the roots, and asks the sidewalk vendor where the roots were grown. Market testing by VISCA economists has been carried out in Ormoc since mid-1984. Sweet potatoes are packed in net bags of three and five kilos, and sold in a corner stand by a popular shopping centre. People come from all over to buy the packed sweet potatoes. With sales ranging from a 6-month high of over 400 kilos sold each day, to a low of just under 200 kilos Dr Saladaga is satisfied with the sweet potato. "We are no longer the exclusive seller of the new varieties. Now they can be found in abundance in the public market," he says. This is the sweet success of all his efforts. □

Paul Icamina is a science writer with the Press Foundation of Asia in Manila.



*"It is perhaps in India
that the dangers of
unchecked
urbanization are
most visible."*

THE ILLS OF URBANIZATION

INDIA LOOKS FOR A SOLUTION

ANDRÉ MCNICOLL

There is a pattern to the slums of Bombay. The flimsy shacks of the one million homeless poor in this huge Indian city on the coast of the Arabian Sea always hug the water mains. Small holes, illegally and discretely drilled into the mains, and tiny pipes hidden in the dust and rubble provide precious trickles of drinking water. Taking potable water from an illicit source, in a city where the daytime temperature can rise above 40 degrees Celsius, is not a crime — it is staying alive.

In Africa, the populations of Nairobi, Dar es Salaam, Nouakchott and Lusaka have all increased seven fold in the last 30 years. Bombay, Mexico City, Cairo, Lagos, Rio de Janeiro, Bangkok — everywhere in the developing world the ravages of unbridled urban growth are beginning to rival famine and drought in the hierarchy of brutalities inflicted on the weak.

In the 140 one-million-plus cities of Africa, Asia, and Latin America, the pressure of overpopulation threatens a fragile and inadequate services infrastructure, especially for the provision of fresh water, the disposal of human waste, housing, health care, and transportation. In Cairo, four million people live in homes without sewer connections. Carlos Fuentes, one of Mexico's most famous writers, describes his capital as "the city forever spreading like a creeping blot". In Bombay, during heavy monsoons, drains are so clogged that raw human waste floats in the streets

contaminating already scarce fresh water supplies. Bombay, as so many other megacities of the Third World, is poised on the edge of a potentially catastrophic disease epidemic.

It is perhaps in India that the dangers of unchecked urbanization are most visible. Delhi attracts 170 000 migrants each year, Bombay about 350 000, and the population of Madras increased by more than 75 percent between 1971 and 1981. For these and other cities, with their limited taxation powers and inadequate grants from Central and State governments, to provide basic services is a daunting and maybe an altogether impossible task.

In 1963, the Committee on Augmentation of Financial Resources of Urban Social Bodies, better known as the Zakaria Committee, established norms for key municipal services such as water supply, sewerage and sewage disposal, construction of roads and parks, education, and health services. But the Committee's report was based on macro data which did not take into account the financial resources of each State and local body. In 1981, the Ministry of Finance and the Ministry of Works and Housing asked the National Institute of Urban Affairs (NIUA) to assess the existing financial structure of the local bodies. The valuable data base that resulted indicated an unbridgeable gap between available resources and those required to provide adequate basic urban services. It

was estimated, for instance, that to upgrade sewage and sewerage treatment facilities in the 216 cities of more than 100 000 inhabitants, would cost about CA\$174 million.

With funding support from IDRC the NIUA will go one step further in its research. It will look at the management capability of local urban bodies with a view to optimizing the use of existing resources and upgrading the provision of urban services. The advantage of optimizing resources utilization rather than financing costly new resource inputs was shown several years ago in the ill-fated city of Bhopal. At the time, the municipal corporation had to deal with a severe shortage of fresh water but rather than embark on an expensive program of capital investment, it decided to look at the possibilities of improving the utilization of existing water resources. Construction of low-cost overhead tanks with tubewells, for example, resulted in a better water distribution system as well as a higher overall level of supply. The Indian cities to be studied by NIUA are: Bangalore, Bombay, and Lucknow (one-million plus); Bhopal, Derakattai, Dhoraji, Hosangabad, Kadi, Sehore, Tiruchirapalli, Vadodara, and Villupuram (medium and small cities); and, Gangtok (a hill town in Sikkim).

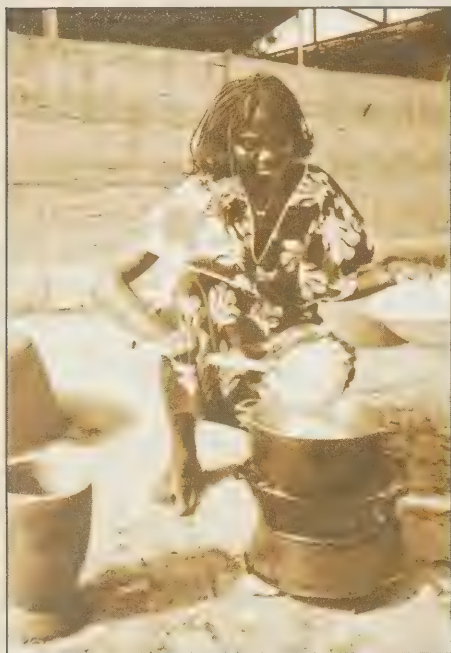
The NIUA has already been charged with planning a national urbanization policy for India. One of the core goals of this policy is to redirect urban growth away from huge centres such as Delhi and Bombay, to small- and medium-size towns. Such towns would become "catalysts of development", according to Dr. K. Sreeram at the NIUA. Their benchmark population would be one lakh (100 000), and they would be the headquarters of a subdivision or district, and already have a market function. Some 225 such "catalysts" have been identified. One way to promote their development will be through significantly upgrading their services infrastructure. Presumably, if people have a choice between the choking congestion, pollution, and other miseries that come with being trapped in an out-of-control megapolis, and life in a dynamic, well-serviced, and relatively clean medium-size city, they will select the latter. If India succeeds in redirecting urban growth it will be a great spark of hope for many countries. If it fails, a plague of urban ills may replace famine as the scourge of humankind. □

André McNicoll is a former senior writer, IDRC.

COOKSTOVES

OPEN FIRES STILL THE PEOPLE'S CHOICE

DEBORA COWLEY



as part of national energy strategies. Originally, it was hoped that the newly-designed stoves would save up to half the firewood normally used and that their use would reduce the rate of deforestation.

While some of the newly-designed stoves have been successful to varying degrees, results show that, in fact, the stoves are not meeting their promoters' initial expectations. Some of the "improved" designs are no more efficient than traditional stoves. Others do perform efficiently but don't necessarily suit the user's particular needs and villagers prefer their old familiar stoves and traditional cooking techniques.

It is also becoming clear that the newly-designed stoves, while they bring some useful savings at the individual level, have little impact on reducing the overall rate of deforestation. Growing populations' demand for more timber, cropland and fuel are consuming forests at a faster rate than the new stoves can conserve it.

ing, light and warmth. It has many advantages. It is readily adaptable in size and shape and in the type of fuel it can burn. It requires few and inexpensive accessories, can be built wherever convenient, and is easy to start and maintain. In its simplest form, it consists of just three stones placed together to support the cooking pot which is propped over the centre of the flame. Twigs are fed through the gap in the stones and the flames fanned by simple hand bellows.

An open fire serves other functions besides cooking. It is often used for curing and drying foodstuffs, its smoke helps in the preservation of roofing and extermination of termites. It frequently is used for heating and where kerosene lamps, candles or electricity are not available, it serves as the only source of light.

However, an open fire can be dirty and dangerous to use. It is more susceptible to drafts and the air flow through the fuel bed is difficult to control. More important, it is extremely wasteful: heat radiates out in all directions rather than being directed to the bottom of the pot, so the vast majority of it heats the room, which is not always desirable.

Most traditional stoves are simple adaptations of an open fire. They may, for example, help shield the fire from drafts, or place it on a waist-high platform to make it easier to use. Others are actually adaptations of designs dating back centuries. These include the mud or pottery stove found in many Asian countries, the metal "jikos" and "fourneaux" popular in East and West Africa, and the heavy brick or mud stoves used in other countries.

"Stoves which the designers have shown to be efficient under ideal conditions may actually increase wood consumption."

SAVINGS DEPEND ON USER

However, studies do show that well-designed stoves can save fuel, if the stoves are used correctly. Such fuel savings are difficult to calculate, however, and vary from one user to another depending on how often the stove is used and if it is used just for cooking or for heat and light as well. Stoves which the designers have shown to be efficient under ideal conditions may actually increase wood consumption. Stoves designed to operate efficiently by being more or less air tight may devour wood when they become cracked or the doors are left open to provide light. One study showed that people may use 33 percent more wood using the "improved" stoves than they do with open fires.

Existing patterns of fuel use are difficult to alter. In virtually all Third World countries, the open fire in its varying forms is the most common method of providing heat for cook-

HARD TO ASSESS EFFICIENCY

It is difficult to define and assess the actual fuel efficiency of cooking stoves because of the difference between their use in a laboratory and in the field. Different types of wood may be used (the moisture content of wood, for example, has a major effect on the amount of energy produced). Wood is used more sparingly when the cost is high and the supply limited. And if it is being used for light and heat as well, it will consume more fuel.

Wood consists largely of carbon compounds, water and smaller quantities of tars and resins, minerals and non-combustibles. When the surface of the wood is heated to about 150°C by a match, flame or focused sunlight, it begins to char and break down, forcing heat into the interior of the wood. This heat vaporizes the tars and resins which in turn react with the charring wood to form volatile gases which, in the presence of oxygen, will ignite.

A precise amount of oxygen is needed to mix with the gas for efficient burning.

At the opening of the 1981 UN Conference on New and Renewable Energy Sources, held in Nairobi, a group of village women marched before the international gathering clutching large bundles of firewood and laid them before the assembly. This one event, more than any other, focused world attention on a crisis facing most Third World countries: the serious destruction of forests threatening their sole supply of firewood.

An area of forest can supply fuel for a set population indefinitely. But population growth has violated the balance that allows the forest to be self-renewing. First, the forests are cleared to create more cropland. As a result, more people must obtain more firewood from a diminished forest area. That forest is no longer able to replace the wood harvested from it.

As more and more trees are hacked down for household fuel faster than new seedlings can grow, the major energy source for nine out of 10 Third World households is literally going up in smoke.

Crash programs to increase reforestation are already under way. But there is more chance of success if, at the same time, ways can be found to conserve existing firewood supplies. One is through the improvement of cookstoves, used extensively not only for cooking but for heat and light, in order to reduce the amount of wood fuel they consume.

SAVE FIREWOOD, REDUCE DEFORESTATION

Cookstove programs have been operating in the Third World for over two decades

MORE CHARCOAL PER CORD

Charcoal is the most popular fuel in the urban areas of East Africa because it is easy to transport, compact and relatively smoke free. As more and more people move to the cities, the demand for charcoal rather than firewood is increasing. If the new clay or metal stoves, which can be twice as efficient as the traditional ones, are widely accepted, even more people may switch to charcoal from firewood, paraffin or gas.

The overall effect would be a decrease in energy consumption and a saving of foreign exchange but the total use of charcoal might actually increase. This makes it more important than ever to make the production of charcoal as efficient as possible.

Independent villagers and small-scale farmers produce most of the charcoal in Tanzania. They use a primitive earth kiln in which the wood is dumped in a pit or pile and covered with layers of green vegetation and with earth. The layer of earth restricts the air supply and allows the incomplete combustion that results in carbonization.

Although this method is simple and inexpensive, it is also inefficient. Attempts to introduce portable metal kilns have met with little success. The metal kilns are twice as efficient as the earth ones, but they demand a large initial capital outlay, technically complicated operation and a supply of uniform wood. These factors have combined to make the kilns unacceptable to most producers.

An IDRC-funded research project is currently being conducted by the Tanzanian Timber Utilization Research Centre. Traditional earth kilns of various designs are being studied and compared for acceptability and efficiency. Minor modifications may improve the traditional method without adding unduly to the complexity or cost of the process. □



In the town of Richard Toll in the Senegal River Valley, all charcoal is produced using the traditional fire pit method.

Insufficient air results in incomplete combustion and the volatile gases will escape unburned as smoke. In open fires, or where the wood is spread out, too much air will dilute the volatile gases and lower the temperature below their ignition point. Some of the fuel is blown away as smoke before it can be burned.

Bearing these facts in mind, it is possible to suggest some improvements to existing cookstoves in order to make them more fuel-efficient.

Combustion efficiency could be improved in several ways: by insulating the firebox, the chamber where initial combustion takes place; by placing the pot where it receives a large portion of radiant energy released by the fire; and by controlling the air flow with grates or baffles.

Proper chimneys and dampers (moveable plates in the chimney which control the draft) would make the fire easier to light and would allow smoke to leave the kitchen. However, chimneys can be counterproductive if they are poorly built, fitted or maintained.

Short chimneys which discharge just above the stove are easier to maintain and cheaper to build than full length ones. They offer the advantages of having smoke in the home (curing meat, protecting the roof, killing termites) while they remove the discomforts of smoke in the eyes and lungs.

THE ROLE OF WOMEN

Improved designs should, wherever possible, be based on the use of locally available material. It is also important to encourage inventiveness and to train local people to develop their own technical skills so that they can adapt, produce, maintain and operate stoves efficiently. Women, who are the main fuel gatherers and the prime users of stoves, must be encouraged to play a major role in both the design and the dissemination of stoves.

In designing improvements to stove models, it is important to remember that what suits one user does not necessarily suit another. One stove will never suit all the individual needs of different people, places and customs. Existing patterns of wood fuel consumption and cooking procedures should be considered in relation to local religious, social and economic customs in the planning of stove programs. The cooking needs of a street vendor, a housewife and a commercial baker all suggest different types of stoves.

Finally, stove programs must be related to other development occurring in the area. Such programs work best when they are integrated into an overall scheme of development. □

Debora Cowley is an Ottawa freelance writer.

KIMAKI JIKO

AN IMPROVED STOVE FOR URBAN KITCHENS OF EAST AFRICA

FIBI MUNENE



A jiko is tested for efficiency.

Instead of waiting up to three or four hours, Mrs Mary Nyambura serves githeri (maize and beans) meal after only one hour, when cooked over an improved cooking stove. Sukuma wiki takes about 10 minutes to cook instead of the usual half hour.

The stove is smokeless and can provide up to 300°C for all domestic cooking. Although designed to use charcoal and wood, waste materials like maize cobs, rice husks, coffee husks, nut shells, grass, saw-dust and even old newspapers can provide fuel for this stove.

Introduction of improved cooking stoves is one of the measures being taken to help the people of East Africa cope with a growing shortage of fuelwood. African countries are almost wholly dependent on firewood for cooking, lighting and heating. In Eastern Africa, for example, firewood is estimated to provide 96 percent of all energy used in Tanzania, 90 percent in Uganda and 80 percent in Kenya.

ENVIRONMENTAL DAMAGE

Decades of clearing forests for agriculture or for sale as timber have combined with the dependence on wood fuel to adversely affect the environment, especially in the drier regions of Eastern Africa. Concentrated fuelwood collection particularly on the steep hillsides and catchment areas has contributed to soil erosion, flash flooding and drying up of perennial streams. This has led to disruption of the environment and agricultural production, and severe straining of wood resources.

Deterioration of the environment caused by deforestation, exacerbated by the high demand for firewood, has awakened the public, governments and scientists in the region to the danger of spreading deserts.

measure towards narrowing the gap between the rising woodfuel needs of a growing population and the diminishing forests.

Although many of the stoves developed over the last couple of decades have not proved to have either the acceptability or efficiency that designers predicted, researchers are finally beginning to realize the real-life parameters they are dealing with.

EXPANDING CHARCOAL MARKET

In the rural areas, people (usually women and children) gather small branches and sticks from the nearest source. Because they rarely chop down large trees but merely collect small and often dead material, experts are increasingly reluctant to say that these wood gatherers cause deforestation. But increasing urbanization brings with it an expanding market for charcoal, the compact fuel made by charring wood in the absence of air.

Although charcoal contains only about a third of the energy of the wood from which it is made, it has twice the kilocalories of an equivalent weight of wood and is therefore the most economical fuel for transporting long distances and storing in crowded cities. The charcoal industry is commercialized. The urban consumers pay money (up to 40 percent of household income in some African cities) for their fuel and are therefore more likely than the rural wood gatherers to be willing to invest in efficient stoves.

Simple metal charcoal-burning stoves are commonly used in urban areas. These can be built from scrap, are inexpensive and accommodate the traditional cooking systems. So while the common metal stoves are very inefficient, new stove designs will have to take into account the advantages of the traditional cooking techniques if they

are to be acceptable alternatives. People will not switch because of an abstract concept such as deforestation but because of proven savings in the face of rising fuel prices.

Clay stoves based on Asian models can burn more efficiently than the traditional metal stoves of Kenya. But these stoves deteriorate within two or three years and require a change in traditional cooking practices. The practice of lowering pots into the fire boxes, for example, is not usual in Africa.

With a grant from IDRC, a researcher from the University of Nairobi, Dr Maxwell Kinyanjui Miring'u, has developed a modified version of the traditional metal "jiko" (cook-stove) which burns either wood or charcoal. Dr Miring'u's kimaki jiko does not depart from the traditional cooking system and yet fits into the modern kitchen.

STOVE DOUBLES AS CHARCOAL MAKER

The stove will broil, bake, boil and roast, qualities which make it acceptable to urban cooks who use more methods of cooking than the rural women. The portable kimaki stove is made with sheet metal from used oil drums and is balanced on iron bars welded from scrap. It can convert small quantities of wood into charcoal at the same time as the fire is cooking. As developing countries become more urbanized and therefore use more charcoal relative to wood, more energy will be wasted unless the charcoal-making technology is improved. The stove can operate as an efficient charcoal-making kiln, adapted to use part of the two-thirds of total energy normally wasted during charcoal-making.

An additional modification is a secondary burn chamber with a separate supply of preheated air to burn combustible gases that would otherwise escape as smoke. Notable design features include the air vent slides, which enable the user to control the spread of combustion or to turn off the fire completely when cooking is finished. The kimaki jiko has the ability to provide smokeless cooking heat from wood, scrub, dry leaves, cowdung, sawdust, wood shavings or wastepaper. When used with charcoal, the cooker is estimated to consume one-quarter the fuel burned by charcoal stoves commonly used in Kenya. Thus if this cooker is adapted for household use, a 75 percent reduction in per capita charcoal consumption could be achieved. □

Fibi Munene is Regional Liaison Officer, based in Nairobi, for IDRC's Communications Division.

THE CASSETTE THAT TALKS BACK

MARIO KAPLÚN



Photo by Mario Kaplún

Cassette Forum at work in a "barrio" of Caracas, Venezuela.

These days we hear a lot about 'people creating their own path of development' through local organizations such as agricultural cooperatives, local health committees, housing cooperatives and popular education centres. The potential of these groups is being recognized increasingly, but to realize that potential, these groups depend on the real participation of all those involved. To allow full participation by the members, these popular organizations need to develop internal channels of communication. This is the main reason for the existence of Cassette Forum, a new micromedium.

It was first tried in Uruguay by an agricultural producers' cooperative, made up of small-scale farmers. They needed to set up two-way communications between the central national organization and the local cooperatives, and between the local cooperatives themselves.

CALFORU is a 'cooperative of co-operatives', a central cooperative in Montevideo which markets and exports the produce of the member co-ops. It also backs credit for the collective purchase of inputs, organizes and plans the crops to be produced, and provides technical support to the member groups.

LOW LEVEL OF PARTICIPATION

But the organization had a problem, typical of the cooperative movement as a whole, that is the low level of participation and the lack of cooperative awareness of its members. Like all organizations which are active in the rural setting, CALFORU had serious communication problems. Since it operates in widely scattered locations, it is extremely difficult to maintain an adequate flow of information between the

organization and its local affiliates, which remain isolated, ignorant of the policies adopted by the central agency or of the reasons which led to their adoption. The various attempts to remedy this shortcoming — regular radio broadcasts, a monthly magazine, bulletins and communiqués — were ineffective. Even worse than the failure of the central organization to get information to the local members, was the inability of the local co-ops to transmit their questions, problems and complaints to the central agency.

What was needed was an instrument and a method to allow two-way communications so that local units could be part of the decision making process. More active participation of the member groups would increase their sense of belonging and commitment to the organization. It would also bring forward prospective new leaders to renew managing committees that were growing stale.

I was invited to collaborate and offer guidance in the search for a solution. It seemed to me that the means of communication would have to be tailored for group and intergroup communication. There wasn't any intention of communicating with individual isolated farmers, but to give solidarity to member groups and to link them one to the other and unite them in a common undertaking. The instrument would have to operate over long distances, be simple, cheap and allow verbal communication since that is more successful for popular movements than written communications. We wanted to create a participative dialogue, not merely to transmit a monologue, regardless of its merit.

SIMPLE AND INEXPENSIVE

This led me to explore the potential of portable cassette recorders. The simplicity and cheapness of these small devices were in their favour. Cassettes are particularly suited for the exchange of information because they have two tracks. One records the first part of the dialogue and the other, if one reverses the cassette, can be used by the group to whom it is sent to express their ideas.

Briefly, the Cassette Forum works as follows:

Message All the participating groups periodically receive a collective cassette (i.e. one with a message to all of them) recorded on one track, and dealing with a problem, a consultation or a proposal involving a subject of interest to all of them.

Forums Each group listens to the cassette, comments upon and discusses the problem raised. Once they reach a conclusion, they record their own opinions and proposals on the other track and return it to the coordinating centre.

Listening The coordinating team listens carefully to all the responses, analyzes them, decodes them and organizes them. They then become the basis for a new collective cassette.

New message The next collective cassette always begins with a report to groups which sums up the replies received on the pre-

vious cassette. This isn't done in the conventional way by a speaker, but the voices of the participants themselves are transcribed, reproducing exactly what they said, and recorded.

In this way, all the groups are informed about what the others think; each one listens to the ideas and proposals of the others and can compare them with its own. The original responses are sent back to local units so that they can hear themselves speaking in *their own voices*.

This establishes a relationship between the groups. Regardless of how far apart they are, an opportunity is provided for dialogue, the exchange of experience, reflection and discussion about their common problems and possible solutions. Decisions can be made democratically with the participation of all those who will be affected by them.

If this verbal report shows that the opinions of the different groups conflict, or that the subject needs further investigation before a decision is reached, the participants keep on discussing it in a second, and sometimes, a third forum. Once the subject has been sufficiently covered, the

"All the groups are informed about what the others think; each one listens to the ideas and proposals of the others and can compare them with its own."

collective cassette brings up a new subject for discussion, suggested by one or more of the participating groups, or selected by the central directors.

ACHIEVEMENTS

The experiment enabled us to test the worth of the method, particularly as an instrument for organizing consultations to reach decisions in common. The cassette forum functioned as a new kind of long distance assembly, in which, without travelling away from home, every one took part and could listen to the others. There was a perceptible increase in the frequency of exchanges of communication between the various groups and they even made arrangements to set up joint services which the central organization could not supply.

Once the managers and technical staff of CALFORU had been put in touch with the local units through the cassettes, they revised many of their attitudes, gained a better understanding of small producers, improved the services offered and adopted more realistic policies better suited to the wishes of the affiliates.

THE PARTICIPANTS SPEAK

"Congratulations to whoever had this idea. I've been working for almost thirty years in the fields and this is the first time in my life that any one has given me the chance, practically on my own doorstep, to say what I think and get my opinion listened to. I think it's really important to ask people what they think. Now with these cassettes we can hear what all the other cooperatives think about the same question, it clues one in as to whether what one said is useful, or not much use, or wrong, and if a lot of people think the same thing . . . that helps a lot."

Statements taken from recordings made by groups in the Cassette Forum program in Uruguay.

Beyond the experiment itself, the model showed that it was versatile and flexible enough to be adopted in many other popular action situations, wherever there was a need to set up communications in the form of a dialogue between groups remote from each other which planned to share their thoughts and actions.

The method has been and is being employed with increasing frequency for inter-group communications in such organizations as a School for Fathers in Sao Paulo, Brazil, Indian agricultural cooperatives in Ecuador, the Organization of Popular Education Centres of Venezuela, local women's groups organized in small production workshops in Bogota, Colombia and youth groups in housing cooperatives built by the members in Uruguay. In short, it can mobilize and activate any popular organization and provide it with an autonomous, economical means of communication which is open to all. □

Obviously, in this short article, one can't spell out all the features of this method. For fuller information about it, see Mario Kaplun: Comunicación entre Grupos — El Método del Cassette-Foro, IDRC-TS, 45S, available in Spanish only.

It was with dreadful shock and sadness that all who knew and admired him learned that IDRC's Governor, Professor Nayudamma, lost his life in the recent Air India disaster. Those of us who were privileged to enjoy his friendship over many years feel an immense sense of personal loss.

It is indeed a bitter irony that so gentle a man, who dedicated his life to demonstrating how science and technology can and should be used for human benefit, was struck down by an appalling and abominable abuse of technology. For more than a decade and a half I had heard him advance the concept of "technologies for humanity" of the need "to apply high level science and technology to ground level problems", "to bring modern science to bear upon the problems and needs of the rural poor."

A PRACTICAL TECHNOLOGIST

Though internationally recognized as an organic chemist, specializing in the complex polyphenol-protein interactions upon which leather manufacture is based (in 1965 he received the K.G. Naik Gold Medal for his research), he was truly a practical technologist. "There's little point in understanding the chemistry if you don't know the practical technology," he often remarked.

Professor Nayudamma was raised in the leather industry. After graduating in industrial chemistry he worked in the Institute of Leather Technology at Madras. Impressed by his exceptional aptitude and intellect, the Government of Madras sent him overseas, first to study leather technology at the Northampton College of Technology in England, then on to Lehigh University in the U.S.A. where he earned his MSc and PhD.

A "dirty hands approach" is often used to describe those whose disposition tends more towards the practical application than to the theoretical consideration of scientific principles. In no industry are dirty hands more evident than in a tannery. During his training both in Britain and the U.S.A., Professor Nayudamma worked in many tanneries learning the practical technology on the factory floor.

He returned to India early in the 1950s as a scientist in the Central Leather Research Institute in Madras. His contribution to the structure, planning and organization of CLRI in its formative years was such that, in 1958, he was appointed its Director, a position he held until 1971 when he was promoted to become Director-General of the Indian Council of Scientific Research and Industrial Development and Secretary to the Government of India in the Department of Science and Technology. The Director-General's position in CSIR must surely be one of the most demanding in the world of science. CSIR, an organization that embodies over 40 specialized research institutes employing 20 000 people, embraces almost all the industrial technologies of India and the scientific disciplines upon which they depend.

The Director-General of the International Rice Research Institute, Dr M.S. Swaminathan, was a colleague of Professor Nayudamma and says of his work: "As Director-General of the Council of Scientific and Industrial Research he will always be remembered for initiating an integrated rural development program in the Karim Nagar district of Andhra Pradesh based on a detailed understanding of the natural resources of the area. He was a pioneer in the field of compilation of resource inventories with the help of aerial photographs."

PROFESSOR YELAVARTHY NAYUDAMMA

A GRATEFUL APPRECIATION OF A DEAR FRIEND

JOSEPH H. HULSE



The late Dr Yelavarthy Nayudamma.

*"He was a man of
unusual tolerance
and compassion."*

Throughout the period he was Director

of CLRI and Director-General of CSIR, Dr. Nayudamma found time both for academic and international activities. For many of these years he was Honorary Professor and Head of the Department of Leather Technology at the University of Madras. The students to whom he lectured and those whose thesis research he supervised are to be found not only throughout India, but in more than 30 developing countries. In 1981, a year before he accepted the invitation to join IDRC's Board of Governors, Professor Nayudamma was appointed to the highly prestigious position of Vice-Chancellor, Jawaharlal Nehru University in New Delhi.

For almost twenty years Professor Nayudamma was a senior consultant and adviser to various United Nations technical agencies, first to FAO then UNDP, UNIDO and UNESCO. Though leather technology and the efficient use of animal by-products remained his dominant interest, his advice was sought by the UN agencies and more than 50 developing countries over a wide range of issues relating to science and technology policy, and industrial and human resource development. One of the UN agencies makes special reference to "his statesman-like advice on conceptual and innovative approaches to technology policy and development."

SPEARHEADED MOVEMENT

In recent years Professor Nayudamma brought his remarkable talents to the direction of the Committee on Science and Technology in Developing Countries. Dr Swaminathan says: "As President of COSTED he spearheaded a movement for the appropriate integration of traditional and emerging technologies." COSTED, established in 1966 by the International Council of Scientific Unions (ICSU), was described by Professor Nayudamma as the "conscience of ICSU and the central instrument to catalyze, coordinate, collate, collaborate and synchronize activities of ICSU in developing countries; its goal is development; its tool is technology; its objective is to catalyze growth and to propel progress."

It would require a lengthy book to describe his many and varied accomplishments, and the extraordinary range of intellectual, philosophical and tangible benefits for which we are indebted to him. He was a man of unusual tolerance and compassion. He deplored religious and racial bigotry and was justifiably proud of having within his household at least five different religious faiths.

Pascal wrote: "The strength of a man's virtue should not be measured by his special exertions but by his habitual acts." Nayudamma's habitual acts were acts of gentleness, generosity, thoughtfulness and caring about the needs and concerns of others. As Dr Swaminathan says, "He was a true Karma Yogi in the ancient Indian tradition and found personal joy and spiritual fulfillment in a job well done."

He was indeed a good man. We shall not look upon his like again. □

Joseph Hulse is IDRC's Vice-President, Research Programs.

NEW RELEASES

Pasture improvement research in Eastern and Southern Africa: proceedings of a workshop held in Harare, Zimbabwe, 17-21 September 1984. J.A. Kategile, ed. Published August 1985. IDRC-237e.

This publication describes the proceedings of a meeting of pasture scientists in Eastern and Southern Africa. The meeting convened to review pasture research, discuss research methodologies, and draw up a regional strategy for research on the improvement and management of pastures for the small-scale farmer. (Will be available in French, Autumn 1985).

Irrigated forestry in arid and semi-arid lands: a synthesis. F.B. Armitage. To be published October 1985. IDRC-234e.

This synthesis is aimed at enhancing irrigated forestry through an examination of past experience, the range of inputs required, and the benefits of integrating tree plantations with irrigated agriculture. It reviews the potential for irrigated forest plantations in arid and semi-arid lands and provides a checklist of economic, sociological, and technical criteria needed to guide decisions as to the feasibility of such developments.

Actions to be covered in the planning, implementation, and operational phases of irrigated forest plantations are indicated as are illustrative production levels and research needs. The closing chapters review the approaches in economic analysis, management, and planning.

Research Methodology for Livestock On-Farm Trials: Proceedings of a workshop held at Aleppo, Syria, 25-28 March 1985. Thomas Nordblum, Awad El Karim Ahmed, Gordon Potts. Published September 1985. IDRC 242e (combined English, French, Arabic). Arabic version to be available October. French version to be available Spring 1986.

This document contains 12 papers detailing a variety of research methods used by animal researchers, presently from the Middle-East region, in conducting on-farm trials involving livestock. Methodological summaries, reflecting issues raised in the papers and presented in discussion groups, are presented on definition of the research problem, trial design in on-farm experimentation, farmer participation, criteria for evaluation, and future directions. The 35 participants from eight countries included both

biological and social scientists who have conducted livestock research with farmers. Although the animal-production systems (sheep, goats, beef, dairy) and the type of facility (open range, feedlot, farm) differed, the papers emphasized research methods used to test improved technologies for livestock in on-farm trials.

International Computer-Based Conference on Biotechnology: A Case Study. Published August 1985, IDRC 241e, 108 pages. (Will be available in French.)

An international computer conference on the bioconversion of lignocellulosics for fuel, fodder, and food took place from May to December 1983. Its purpose was twofold: to assess the appropriateness of computer conferencing for scientific discussion and to explore the usefulness of bioconversion for developing countries. Individuals intimately involved in the organization and evaluation of this activity contributed chapters documenting the background, organization, operation, evaluation, and results. These chapters reflect the personal views of the authors, allowing the reader to view the activity from a number of different perspectives.

Small-Scale Fisheries in Asia:



Small-scale fisheries in Asia: socioeconomic analysis and policy. T. Panayotou, ed. Published August, 1985, 284 pages. IDRC-229e.

This volume is a partial response to the growing need for a better understanding of the constraints and opportunities facing small-scale fisheries. It contains 27 papers on small-scale capture and culture fisheries from five Asian countries — Bangladesh, Malaysia, Philippines, Sri Lanka, and Thailand — based on original field research sponsored by IDRC. The book describes and analyzes the socioeconomic conditions of small-scale fishermen in these countries, evaluates government policies, and proposes policy alternatives.

Finfish nutrition in Asia: methodological approaches to research and development. C.Y. Cho, C.B. Cowey, and T. Watanabe. Published July 1985, IDRC-233e, 154 pages.

Knowledge of fish nutrition is fundamental to most aquaculture practices in Asia. Although IDRC research

broodstock and larvae, and approach and design of nutrition experimentation, as well as an extensive reference and suggested reading list.

Part II presents the proceedings of the Asian finfish nutrition workshop held in Singapore, 23-26 August 1983. Included are research papers dealing with a variety of questions that are important for countries within the region.

preliminary proposals are also presented in the form of "project leads".

Chinese-character processing for computerized bibliographic information exchange: summary report of an international workshop held in Hong Kong, 17-20 December 1984. Published July, 1985, IDRC-239e, 68 pages.

This publication summarizes the discussions at an international workshop on Chinese-character processing for computerized bibliographic information exchange held at the University of Hong Kong in December 1984. The workshop covered both general topics concerning Chinese data bases and international information exchange as well as specific issues of character coding, input and output methods, regional and international standardization, and software development.

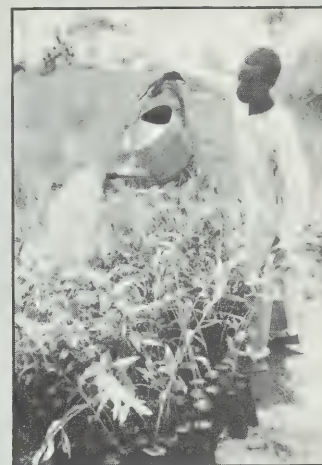
Devindex 1984: index to selected literature on economic and social development. Published June 1985, IDRC-240e,f. 172 pages.

Topics include: prescriptions for decision-making, development action - operational experience, consequences and evaluations, and resources and tools for development. Annotations are in English and French.

Women's issues in water and sanitation: attempts to address an age-old challenge. Published July 1985, IDRC-236e, 104 pages.

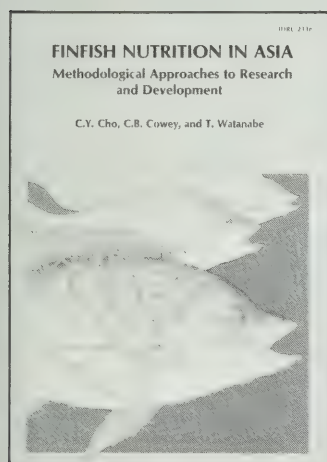
A seminar on "Women's Issues in Water and Sanitation" was held in Manila, Philippines, 24-26 September 1984 to discuss the problems and constraints that have limited women's participation in water and sanitation activities in the past and identify ways in which their roles can be enhanced in the future.

This publication documents the results of the seminar by reviewing women's past efforts in water supply and sanitation activities and presenting abstracts of papers about ongoing research. In addition, the 62 representatives from Africa, Latin America, the Middle East, and Asia were divided into four working groups and asked to develop ideas for future research. These



Trees of Hope. Released August, 1985. The 18-minute film, produced by IDRC's Communications Division, was shot on location in Niger, Mali, Senegal, and Nigeria. English and French copies available as 16mm prints or in U-matic, VHS, or Betamax video formats. Video cassettes are in NTSC, PAL or SECAM signal systems. "Trees of Hope" can also be borrowed from IDRC regional offices and most Canadian Embassies or High Commissions in developing countries, and in Canada from National Film Board libraries.

In some African countries, 90 percent of all energy requirements comes from firewood. Unfortunately, consumption for human needs outstrips natural regeneration, and hungry animals attack the remaining vegetation. When the rains fail, the desert advances. "Trees of Hope" documents this rapid deforestation and analyzes various solutions such as shifting to solar energy and improving traditional stoves. It emphasizes the importance of reforestation using the example of a village woodlot project in Niger where foresters have exchanged their traditional role of wardens for that of rural-development workers. The film documents how they teach people to plant their own trees for firewood and construction materials. This and other IDRC projects in Africa have fostered national movements that provide hope for the fragile lands of Africa. □



support aims, in part, to promote the culture of species requiring no supplementary feeding, it is recognized that formulated feeds are required to increase productivity of many important species now being cultured within the region.

Many of the basic approaches to applied nutrition are not readily available to researchers. Thus, part I of this publication deals with methodological approaches to research and development. Included are discussions on nutrient requirements and deficiencies, fish feeds and their quality, feeding practices, nutrition of

In addition to IDRC *Reports*, the Centre publishes a wide range of material on development issues. These include scientific monographs, reports, and bibliographies on specific IDRC research areas, as well as general interest literature. These publications represent research interests and activities supported by IDRC in agriculture, food and nutrition, population, health, education, information, and social sciences. Films describing the Centre and some of the areas of development research are also available. A catalogue of current material, publications or films, is available from the nearest IDRC regional office or from IDRC in Ottawa (see page 3 for complete addresses).

Publications may be ordered from the IDRC sales agents listed here.

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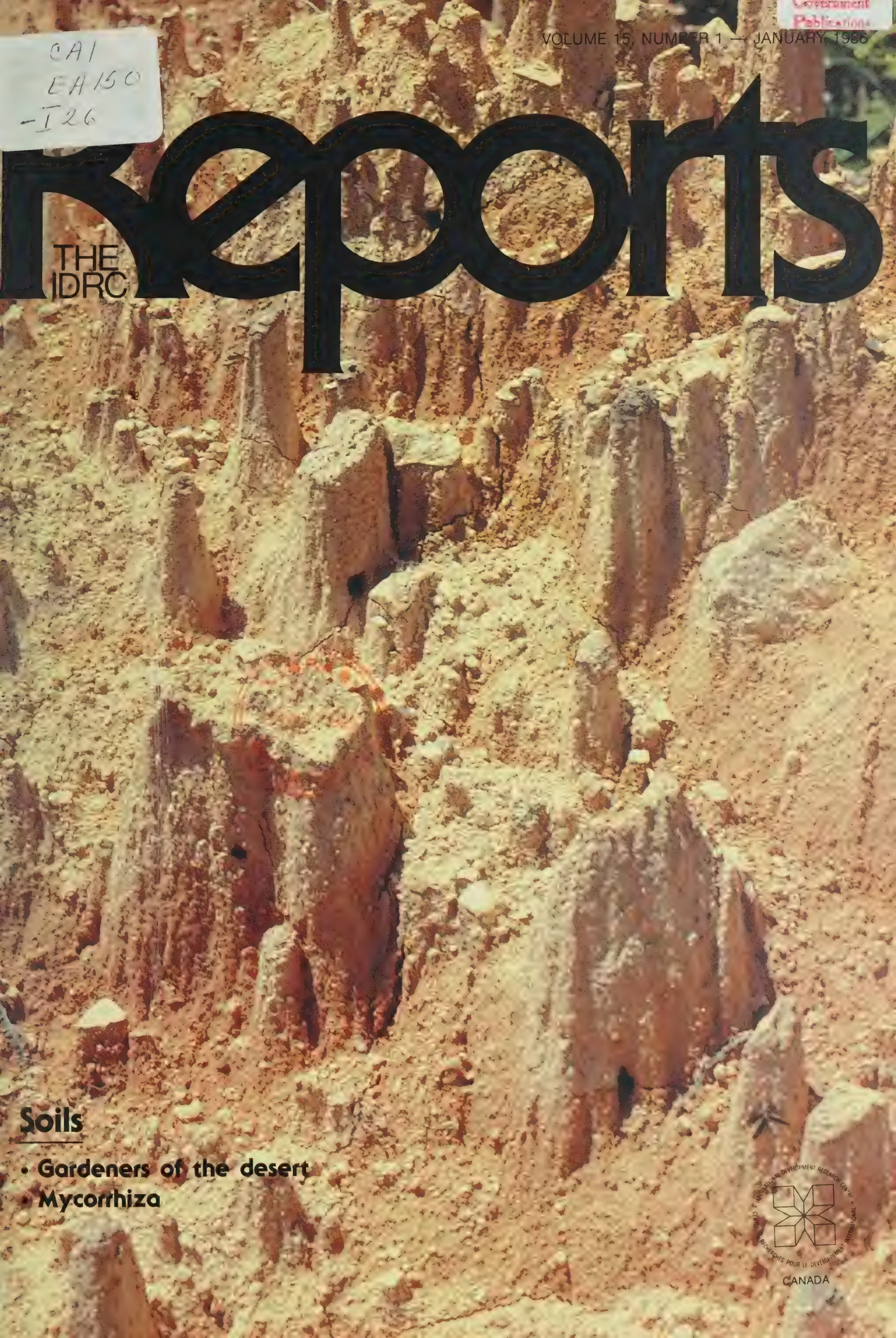
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VOLUME 15, NUMBER 1 — JANUARY 1986

Government
Publications

Reports

THE
IDRC

Soils

- Gardeners of the desert
- Mycorrhiza



LETTERS

Fluorosis in Africa

We learned from *Le CRDI Explore* [French edition of *The IDRC Reports*, April 1984] that certain African countries, including Rwanda, have a problem with fluorosis. Could you please provide us with more information on this subject.

According to health statistics available to us, this disease is not currently a public health problem and we are therefore very interested in knowing the source of the baseline data, the methodology, and the conclusions of your study.

It would also be very desirable to know the hypothetical or proven causes of this disease in our countries and the proposed solutions to this health problem.

Dr François Muganza
Minister of Public Health
and Social Affairs
Kigali, Rwanda

The following is an abridged version of the letter of reply by Ivan L. Head, president of IDRC:

IDRC is currently financing a fluorosis research project led by J.N. Gitonga of the University of Nairobi's Civil Engineering Department. The first phase of the study confirmed the endemic character of the disease in Kenya's mountainous regions. In the second phase, now in progress, the researchers will evaluate different techniques for defluoridating drinking water.

The journalist who wrote the article had attended a workshop on fluorosis in June and July 1983, organized by the University of Nairobi's Department of Dental Surgery and by Kenya's Council for Science and Technology. Scientists there explained that in the countries of the Rift Valley, from Saudi Arabia to Malawi, water often contains fluoride because of the volcanic nature of the soils.

Looking at the workshop program, the journalist noted that Rwanda was included on the list of threatened countries.

Our Nairobi office also informs us that a representative of Rwanda's Ministry of Natural Resources participated in the workshop.

We will be happy to send you any new, useful information that may result from the project we are supporting in Kenya.

Editor's Notebook

The photos illustrating the article "A head start: Preschool education in Turkey" in our July 1985 issue (Vol. 14, No. 2) were the work of Robert Richter and not of the article's author, Libby Bassett, as indicated. *Reports* regrets the error.

We would like to take the opportunity provided by this correction to mention that Mr Richter also produces documentary films. *Hungry for Profit*, his most recent, examines hunger and agribusiness in developing countries. Among other things, it focuses on the conflicts between small farmers and the big plantations which export their crops to pay off debt and earn foreign exchange. This 86-minute documentary, which has already been aired on the Public Broadcasting System in the United States, also suggests alternative solutions to the problems raised.

For more information, contact Richter Productions, 330 West 42 Street, New York, N.Y. 10036, U.S.A.

Mosquito control through radiation

I was interested to see the article "Malaria: The king is threatened" by Nancy Johnson Smith, appearing in *The IDRC Reports*, Vol. 13, No. 4, January 1985. It is unlikely that the genetic strain of the mosquito species resistant to the malaria parasite can successfully compete with the resident strain in an area to eliminate malaria. Genetic manipulation, species by species, of malaria mosquitoes in itself will be time-consuming work even when successful.

Malaria is not the only disease communicated by mosquitoes; others include filariasis, yellow fever, dengue, and even viral fevers. So a method applicable in the control of all species is necessary. In the forefront in this area is genetic manipulation, specifically the use of insects rendered sterile through radiation. This method holds out greater promise in control of mosquitoes without concomitant disadvantages of other methods.

The method consists in overwhelming the natural population with sterile males of the species, reared and sterilized with gamma radiation. This involves: 1) an easy and economic method of rearing the species in large numbers; 2) an easy method of separating the males; and 3) determination of the radiation dose and the stage at which the insect should be irradiated to ensure complete sterility of sperms. That the method is suitable for control/eradication of harmful insects is already proved. The method is aesthetically acceptable and environmentally sanitary.

India is a country plagued by mosquitoes which are considered suitable candidates for control by this method. So laboratory studies were undertaken

at the Institute of Nuclear Medicine and Allied Sciences, Delhi, to establish the suitability of the method in the control of the mosquito *Culex pipiens fatigans* Wied. "Laboratory studies on radiation-induced dominant lethality in sperms in population control of the mosquito *Culex pipiens fatigans* Wied" was published in the *International Journal of Radiation Biology*, 1970, Vol. 18, No. 6, 521-530. A convenient method for rearing and sterilizing the male mosquitoes is described and other parameters were met satisfactorily. The radiation dose administered had no adverse somatic effect and the competitiveness of the irradiated males was found to equal that of the normal males. The ratio of the sterile eggs obtained was equal to the ratio of the irradiated males to the normal males released in the breeding chamber.

The techniques and the results obtained favoured the application of the method for control of the mosquito in the field. Limited field work followed and the results confirmed the results obtained in the laboratory.

This expertise, I am confident, can be applied to other species of mosquitoes and the mosquito menace in many places could be controlled/eradicated.

I shall be glad of any queries on the subject.

Thomas Koshy
F. 38, Kalkaji, New Delhi 19
India

Letters from readers are welcomed and should be addressed to:
Editors, *The IDRC Reports*
P.O. Box 8500
Ottawa, CANADA K1G 3H9

Reports

THE IDRC

The IDRC Reports and its companion editions in French and Spanish — *Le CRDI Explore* and *El CIID Informa* — are published quarterly by the International Development Research Centre. Their aim is to keep readers informed of the activities of IDRC and to present articles on subjects related to the Centre's fields of interest. An Arabic version *بورتال* is published annually. Copies are available on request from the Communications Division, IDRC, P.O. Box 8500, Ottawa, Canada K1G 3H9. *Editor-in-chief:* Jean-Marc Fleury, *Associate Editors:* Gerry Toomey (English edition), Jacques Dupont (French edition), Spanish edition, Stella de Felerbaum

CONTENTS

Letters		2
Gardeners of the desert	With a little coaxing, Egypt's desert sands are being reclaimed for agriculture. By Jean-Marc Fleury.	4
Mycorrhiza	Marianne Kugler examines the mutually beneficial relationship between plants and fungi.	5
Red Mud: the not-so-shiny side of aluminum	A by-product of the alumina industry is a potential threat to Jamaica, but it may also turn out to be a valuable resource. By Gerry Toomey and Dr Arun Wagh.	7
Pneumoconiosis in South Korea	Denis Marchand reports on the dreaded occupational disease of coal miners.	9
Land reform is not enough	A look at land tenure and farming problems in Antigua and Montserrat. By Frank Campbell.	11
The latrine comes to N'Goundiane	Ibrahima Bakhoun describes the human and financial difficulties in changing a village's sanitary practices.	13
Workers on the move	Modern international migration is strongly linked to the supply of and demand for labour. By André McNicoll.	14
Healing Hands	The story of three Canadians working with burn victims and medical personnel in Lesotho.	16
Sorghum: The struggle for acceptance	Dr Hugh Doggett has dedicated much of his life to improving sorghum and promoting its use. By Anne Fisher.	18

The cup runneth over	The export of Western culture is helping to give alcoholism a foothold in some developing countries. By Jacques Dupont.	20
Co-ops in Burkina Faso and India	Reports by François Huot and David Creighton.	22
China's human reservoirs	Small towns are helping China to cope with surplus farm labour. By Li Xin.	25
Briefs	News and trends in international development.	26
New releases		27



Cover photo: Soil erosion in Malaysia. This issue of *Reports* looks at several aspects of land use, including the exploitation of soils and sub-soils. See articles beginning on page 4.

Back cover: A dried "red mud" pond in Jamaica with discharge pipe in the background. Alumina extraction has ecological drawbacks as well as economic benefits. See story page 7.

Photo: Gerald Toomey, IDRC

The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in five sectors: agriculture, food, and nutrition sciences; health sciences; information sciences; social sciences; and communications. IDRC is financed solely by the Parliament of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are located at 60 Queen Street, Ottawa, Canada (P.O. Box 8500, Ottawa, Canada K1G 3H9). Regional offices are located in East Africa (P.O. Box 62084, Nairobi, Kenya); West Africa (B.P. 11007, C.D. Annexe, Dakar, Sénégal); Asia (Tanglin P.O. Box 101, Singapore 9124, Republic of Singapore); South Asia (11 Jorbagh, New Delhi 110003, India); Latin America (Apartado Aéreo 53016, Bogota D.E., Colombia); and the Middle East (P.O. Box 14 Orman, Giza, Cairo, Egypt).

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Unsolicited manuscripts and other editorial materials are welcomed and will be considered for publication.

All photos by Neill McKee unless otherwise indicated.

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Bringing fertility to the desert soils of Egypt

GARDENERS OF THE DESERT

By JEAN-MARC FLEURY

Halfway between Cairo and Alexandria, on the western edge of the Nile Delta, Egyptian scientists believe they have discovered how to cultivate the desert.

"The secret," says Ismael El Bagouri, a specialist in soils at the Desert Institute, "is to accept the desert as a desert. We have planted test plots over an area of 80 hectares, and when farmers come to visit us, they leave enthused. I have closely followed a number of soil reclamation projects, but this time, I really believe in it."

After the building of the Aswan High Dam, which was completed in 1972, it was estimated that the cultivable area of the country would increase from 2.5 to 4 million hectares. Various techniques were used to restore degraded soil. "Most of the peasants tried to use the traditional techniques employed in the Nile Valley for thousands of years," says El Bagouri. The fellahs (Egyptian peasants) dug irrigation channels right on the surface. Water was now available throughout the year and the peasants stopped leaving a fallow period and planted two or three crops a year. The result: soil choked and sterilized by salt brought too close to the surface by the rising water table. For the first few years there were excellent harvests, then yields collapsed.

EXHAUSTED TOPSOIL

Because the desert sand has a very low ability to retain fertilizer, peasants enriched it with lime brought up from the bed of the



Leaves and stalks can be used as fodder.

Nile. "That stopped the roots of the plants reaching down far enough, and the thin layer of topsoil rapidly became exhausted," explains El Bagouri. Moreover, the lime contained seeds of harmful weeds and parasites which often were the first things to grow in the new fields.

As for those people with more modern ideas, they tried to improve the quality of the soil by adding clay, bitumens and even synthetic polymers. The cost of these substances, however, was high and they broke down rapidly. In the case of clay, the cost

of transportation alone made it impossible to apply it on a large scale.

RECLAMATION SLOWER THAN URBAN SPRAWL

Despite numerous "desert wars" waged over several decades and under several regimes, Egypt never managed to reclaim more than 300 000 hectares from the dunes of the Libyan and Arabian Deserts. This area was less than that lost to urbanization.

The new methodology evolved in a project funded in part by IDRC and directed by the American University of Cairo. It begins with an examination of the sand to be reclaimed. Right at the start, specialists identify and add the important oligo-elements such as zinc, manganese and iron whose absence can restrict the effectiveness of the main fertilizers — nitrogen, phosphorus and potassium. Instead of digging ditches for open-stream irrigation, the researchers install sprinkler pipes to avoid saturating the soil.

Then, to increase the amount of organic matter, they plant a variety of legumes suitable for arid areas: alfalfa, beans, peanuts, cowpeas, which enrich the deeper soil thanks to their nitrogen-fixing taproots. The first crops serve mainly as forage for small ruminants — goats and sheep — which in turn enrich the soil with their manure. It is only after a certain amount of organic matter has been added that the cultivation of cereals can begin.

In the first years of the experiment the yield was very small. Now, El Bagouri claims, the new methods of cultivation recover their cost very rapidly, often as early as the second year. "That's why last August the Egyptian minister in charge of land reclamation visited the test plots at the research station, half way between Cairo and Alexandria at the gates of the desert." □

MYCORRHIZA

THE BENEFICIAL BONDING OF PLANTS AND FUNGI

By MARIANNE KUGLER

Photo: Valentin Furlan, Agriculture Canada



Ash saplings in experimental soil. The one on the left contains no mycorrhizal fungi. The two others demonstrate the effects of two different kinds of fungi.

Biologically speaking, plants do not live in isolation. But for a long time people believed they did. To help their crops grow, farmers have for many years laced the soil with easily assimilated minerals in the form of chemical fertilizers. Enormous factories have been built at great expense to crush, heat, and treat mountains of rocks in order to offer plants more nitrogen, phosphorus and potassium.

It is now known that almost all green plants grow and flourish in close association with other beneficial organisms. The reason these weren't discovered earlier is that they are microscopic. They are fungi, including bacteria, which live in close association with the roots, and sometimes the stalks, of plants. They live at the expense of the host plant, drawing from it 10 to 40 percent of the nutritive substances it produces. In exchange, these parasites supply the plant with nitrogen, phosphorus, copper and zinc, and secrete substances that inhibit the growth of other pathogenic soil microorganisms. Such a mutually beneficial relationship between two living beings is called 'symbiosis'. The symbiotic association between plants and fungi is called 'mycorrhiza', literally 'fungus-root'.

HELPING PLANTS TO HELP THEMSELVES

The first major symbiotic association discovered in plants was that of nitrogen-fixing bacteria (rhizobium) with the roots of legumes: clover, alfalfa, beans, cowpeas, acacia, etc.

Current research is making it clear that

mycorrhiza associations are almost universal. This creates a new challenge for specialists: to help plants to assimilate not only the omnipresent atmospheric nitrogen directly, but also the numerous minerals within reach of their roots. The potential is enormous, especially for the farmers of the Third World who cannot afford fertilizers and pesticides.

Spectacular results have already been obtained with apple trees in Canada, orange and lemon trees in California, white clover in England, and ash trees in France. Numerous tropical food crops in fact depend heavily on mycorrhiza including cassava, soybeans, *Stylosanthes* (a forage crop), and most of the trees which are useful for their fruit or wood.

Professor J. André Fortin is the Director of the Centre for Forest Biology Research at Laval University in Quebec City, Canada. He has worked on mycorrhizae for more than 25 years. It is clear to him that the forestry and agriculture of tomorrow will make large-scale use of mycorrhizae.

PHOSPHORUS MADE AVAILABLE

Mycorrhizae facilitate the accumulation of phosphorus needed by plants. Without such symbiotic relationships, plants rapidly exhaust the phosphorus in the area immediately around their roots. To obtain more, plants can either wait until phosphate ions spread to the roots or they can grow more roots to reach areas of the soil not yet tapped. Phosphate ions happen to be par-

ticularly slow in spreading, and, for the plant, the energy expenditure to grow additional roots is prohibitive.

On the other hand, mycorrhizal fungi have the property of putting forth a mycelial network made up of multicellular filaments that are extremely fine and very long. Thus, a minimal amount of biomass can tap a large volume of soil; the cost in energy is highly advantageous to the plant. Together with other soil organisms, the fungi make rock phosphate soluble and transfer it to the host plant. In exchange the plant gives the fungi the sugar they cannot produce themselves because they are incapable of photosynthesis.

Most of the trees in the equatorial and tropical forest, fruit trees, and almost all other green plants are associated with lower orders of fungi which are visible only through a microscope. The trees in the temperate and northern forests form mycorrhiza mainly with capped mushroom fungi such as boleti and amanita. This type of association is also encountered in certain species cultivated in tropical regions. It occurs with pine, eucalyptus, gilibertia, and other species.

At Pointe-Noire in the Congo in 1982, the introduction of a selected strain of *Pisolithus tinctorius* fungi, to replace the fungi normally used, produced an increase of 40 percent in the height of Caribbean pines 20 months after the trees were planted.

Mycorrhizal associations do not always take the same form, but generally the same elements are exchanged. Some fungi, the

GETTING TO THE ROOT OF AFRICA'S PROBLEM

Massive doses of chemical fertilizer for agriculture and forestry are a luxury that many developing countries, especially in Africa, simply can't afford. Yet, because of growing population pressures, such countries are the ones that most need to increase food and fuelwood production.

Root symbiosis techniques, which capitalize on the mutually beneficial relationship between plants and soil organisms, hold out great promise as a complement to, and perhaps even a substitute for, costly NPK fertilizers. Third World countries have become particularly interested in the inoculation of plants and trees with indigenous mycorrhizal fungi and rhizobium bacteria. These organisms are able to supply extra phosphorus and nitrogen respectively to plants.

Since September 1984, Laval University's Centre for Forestry Biology Research, in Canada, has been collaborating, with support from IDRC, with a team of biologists from the University of Kinshasa in Zaire. They are testing and evaluating the usefulness of micorrhizal inoculation as a way to produce more food and wood in Zaire. Plants to which the technique is to be applied include cassava, yams, taro, corn, rice, sorghum, peanuts, coffee, cotton, and beans. Tree types will include acacia, leucaena and limba.

Researchers at the University of Sierra Leone are working on a complementary project supported by IDRC. They are attempting to identify fast-growing tree and shrub legumes that can efficiently recycle nitrogen and phosphorus via double symbiosis, namely combined rhizobium/mycorrhiza association with host plants. This research could give a major boost to agroforestry in Sierra Leone.

IDRC is also supporting related work in Morocco. Biologists from the Ministry of Agriculture and Agrarian Reform are investigating the uses of maritime pine, Aleppo pine, and Canary pine, and cedar for reforestation. In connection with this, they are surveying local fungi as well as the state of natural mycorrhizal associations. In addition, they are examining the use of fungi in the production of seedlings for reforestation. One interesting sideline of the project is a study of several edible fungi.



Kije Nkoy-Moke (left) and Khasa Phambu, researchers from the University of Kinshasa in Zaire, with J. André Fortin of Laval University, Canada.

endomycorrhizae, penetrate the root of the host plant. Others, the ectomycorrhizae, remain external.

According to Dr Fortin, there is an urgent need to supply researchers in developing countries with pure endomycorrhizae inocula, free of pathogens, in order to determine whether they have a practical use in such countries where farmers cannot afford phosphate fertilizers.

PRESERVATION OF FUNGI'S HABITAT

"As soon as one is convinced that it is sound practice to use mycorrhizal fungi, one must take care of them. It's only logical," says Dr Fortin. "One has to learn more and more about 'wild' mushroom fungi. Ecological studies show that they exist everywhere even if the quantity varies. If necessary, the most effective ones can be selected and then even improved by genetic technology. Agricultural practice must respect their habitat and avoid destroying them by the excessive use of fungicides."

For example, after deforestation, a drought, or a forest fire, fungi survive only for a limited period in the forest soil and lose the ability to reproduce if they don't find a new host plant. The number of fungi can also be diminished by massive applications of fertilizers. To use mycorrhizae effectively, one has to understand the complex mechanisms involved. Unfortunately, the application of expensive synthetic fertilizers is most often recommended as the easiest solution.

"The usefulness of mycorrhizae is not limited to improving absorption of phosphorus," says Dr Fortin, "although this benefit alone is sufficient to justify the most

general use possible." Mycorrhizal fungi also play a role in the absorption and transfer of other mineral elements such as copper and zinc. What is most important is the part they play in the absorption of nitrogen. Ectomycorrhizae are particularly important in this respect. The phenomenon of symbiosis is not restricted to a single fungus type and plant. There can, for example, be collaboration between bacteria of the rhizobium type, which fix atmospheric nitrogen, and mycorrhizing fungi. It has also been shown that mycorrhizing fungi can play a protective role against fungal diseases. Their ability to produce antibiotics which are effective against phytopathogenic fungi deserves special attention in the quest for alternatives to chemical fungicides.

Recent work has also shown that mycorrhizae increase plant resistance to stress caused by lack of water. This discovery could be of great significance in the struggle against drought.

"It is no longer possible," says Dr Fortin, "to think about efficient agriculture and silviculture, particularly in developing countries, without including the notions of symbiosis in general and mycorrhiza in particular. I am convinced that work now being carried out around the world will bring new proof of this." □

Marianne Kugler is an adviser on scientific communications for the Public Relations office of Laval University in Quebec, Canada.

RED MUD

THE NOT-SO-SHINY SIDE OF ALUMINUM

By DR ARUN S. WAGH AND
GERALD TOOMEY

Under an azure sky, a car heads out of the Jamaican capital of Kingston and winds its way along a narrow hilly highway past green sugarcane fields, banana orchards and ruminating goats. Along the roadside, old women cook "jerk" pork and chicken over fire pits. Young men and children, shaded from the hot Caribbean sun by their fruit stands, wait patiently for passing motorists to buy their strings of tangerines. The landscape brings home the fact that agriculture is the number one sector of the economy. But bauxite and alumina are the most important exports.

After two hours on the road, the car drives through a guarded gate and comes to a halt at the main office and laboratory of Alcan Jamaica's Kirkvine Works in the parish of Manchester. It is one of the four alumina plants on the island. The four occupants of the car have come to tour the operation and meet with the technical staff.

With the financial support of IDRC, a team of Jamaican and Canadian scientists, is studying "red mud", the inevitable waste produced by such alumina plants. Their objective is to reconcile Jamaica's need for foreign exchange with its need to preserve its exceptional environment for tourists and its soil for farmers.

Jamaica's bauxite lies little more than a metre beneath the feet of the island's people. This often rust-coloured earthy raw material contains the important mineral compound Al_2O_3 — aluminum oxide or simply alumina. After export, this is processed into aluminum from which familiar products, ranging from auto parts and roofing material, to foil wrap and cooking pots, are made. Its wide-scale use in the aerospace industry, in fact, makes it a strategic metal.

Bauxite mining and alumina processing generate 75 percent of the export earnings of the country and employ 4800 people. Although seriously hit by the recent recession, the two industries remain key elements in the Jamaican economy, along with agriculture and tourism.



Photos: Gerald Toomey, IDRC



Materials scientist Dr Arun Wagh examines a piece of dried mud.

HIGHLY CAUSTIC SLURRY

Unfortunately, discharge tailings due to alumina production, whether in Jamaica or elsewhere, can contaminate groundwater and adversely affect agriculture because of the land needed for storage of the toxic wastes. This less glossy side of the alumina

"Unfortunately, discharge tailings due to alumina production, whether in Jamaica or elsewhere, can contaminate groundwater and adversely affect agriculture."

industry is a consequence of the Bayer process by which alumina is dissolved out of bauxite with the addition of caustic soda. This yields a highly caustic red mud. In many alumina plants around the world, including four in Jamaica, enormous quantities of this slurry are pumped into old abandoned bauxite mines or natural valleys

with one end dammed up. Such artificially constructed ponds eventually fill up with the waste leading to an environmental problem exacerbated by the fact that Jamaica is an island measuring only 22 000 square km.

In world bauxite production, Jamaica ranks third after Australia and Guinea, with about 11 million tonnes mined every year. Some seven million tonnes of this is refined locally, producing 2.5 million tonnes of alumina and, at the same time, 12.5 million tonnes of liquid waste. According to a 1983 global report on the aluminum industry, published by the Brussels-based Groupe de recherche pour une stratégie économique alternative, Jamaica's estimated and proven bauxite reserves stood at almost 10 percent of the world's total of 32 billion tonnes at the end of the 1970s. If these riches are to be exploited for the country's benefit, the waste disposal problem must be solved.

BEAUTY IS SKIN DEEP

Typically a red mud pond in Jamaica is a massive land depression filled with the waste. It has a slope from the dyke end to the far end. The effluent is discharged near the dyke and flows into the pond, with heavier solids settling at the shallow end and more liquid mass flowing to the deeper side. This results in a drier side of the pond, a "soft-soil" region making up most of the pond, and a liquid side. The rain water also accumulates at the liquid side and makes it look like a lake with a blue reflection of clear sky. A boat or a raft can easily navigate on it.

The dry side has its own appearance too. As the mud dries, due to massive shrinkage, the surface cracks and looks like a drought-stricken area. Some of the smaller abandoned ponds in fact crack into very symmetric concentric circles with the centre at the middle of the pond. At first sight one does not realize that this beauty is probably only skin deep. The Jamaican mud is superfine and is self-sealing. The dry

"The main problem with the existing ponds is that little is known of their internal chemical and physical dynamics."

mud on the surface can trap viscous liquid underneath. One wonders what will happen if the trapped mud under the hydrostatic pressure of the overburden ever finds a way out! Only intensive research on the pond can answer this.

The soft-soil region is deceptive too. The surface may look smooth and uniformly red, but a throw of a stone immediately suggests that anything can sink into it and vanish. A boat cannot be used there because shear forces are too large. The caustic sludge is too dangerous for any such adventure. But since this covers the largest area of the pond, scientists must study the samples in this region to determine the dynamics of the mud. This demands ingenuity from the researchers.

Since the early 1950s, when the alumina and bauxite industries were first established, the caustic red mud has been directly pumped into such sludge ponds. Twenty years later, high levels of sodium concentration in some nearby water sources and wells were observed by the Ministry of Mines and Natural Resources. Increasing sodium levels and frequent accidental spills led the Ministry to monitor the quality of water in these areas and to establish criteria for water safety.

The main problem with the existing ponds is that little is known of their internal chemical and physical dynamics. While the constituent parts of Jamaican red mud are known — mainly iron oxide and residual alumina — many questions remain. How does the slurry settle? How much soda seeps into the aquifers and ground waters? After the dumping stops, what conditions are necessary for the contents to dry? What holds the particles of dry mud together? Is there a risk that the dried material will eventually crumble, turning the disposal sites into dust bowls?

These considerations motivated the University of the West Indies (UWI) in Jamaica and McGill University in Montreal, Canada, to ask IDRC's support for a cooperative research endeavour. Scientists of the Materials Laboratory in the Physics Department at UWI, and Professor Raymond Yong, Director of McGill's Geotechnical Research Centre (GRC), who has experience in the treatment of tar sand tailings in Western Canada, formulated a three-year research program. Its aims are to characterize Jamaican red mud, develop a predictive model of the ponds, and study the potential of Jamaican root starches as flocculants (thickeners). This eventually

Photo: Gerald Toomey, IDRC



evolved into a team effort supported by the local alumina industry (Alcan, Alcoa and Alpart), the Jamaica Bauxite Institute, the Scientific Research Council of Jamaica, and various departments of UWI.

"LET THEM LIVE IN MUD"

Environmental control is only one aspect of the red mud problem. A Jamaican industrialist and a former government minister, R.C. Lightbourne, considered Jamaican red mud a resource and, working with H.B. Baetz, developed and patented a process to extract iron out of the mud. Similarly, the US Bureau of Mines instituted a study on the possibilities of using red mud produced in the United States as lightweight building material.

Lightbourne's vision and the US Bureau's hopes failed, not because their logic and methods were unscientific, but because of the problem of drying the mud. It was uneconomical to produce solid waste. If one could simply remove the water from the mud, it could partially solve the environmental problem and the waste could be useful too.

In this respect a de-watering technique, based on the Guilini process used in Germany and further developed by Alcan scientists, is quite encouraging. In this process, the mud is thickened to almost 50 percent solids by flocculation and then the tropical sunshine is used to dry it further. The result is dry mud which requires much less land for disposal, does not flow and hence does not have the potential to contaminate the local water systems. This could provide the raw material for lightweight building products or for iron extraction.

NEW OPTIMISM

The establishment of some of the basic characteristics of Jamaican red mud under the IDRC-sponsored project and the introduction of the new disposal method have created a new atmosphere of optimism. While there is still concern about the existing ponds, projects are being initiated at UWI to look into the properties of the dry mud.

In an article titled "Let them live in mud", by Anil Agarwal (*New Scientist*, 16 December 1982), it is argued that all developing countries have one resource in common, and that is mud. In the case of red mud, the current research project is unique. It attempts to solve the waste problem of the major industrial activity of Jamaica, preserve the environment, and generate resources out of the waste. Expecting prosperity out of it may be a romantic dream, but certainly such research will develop indigenous technology hitherto unknown to the industrialized world. □

Dr Arun Wagh, one of the co-authors, is a materials scientist in the physics department of the University of the West Indies (Kingston) and heads the red mud research project.



In South Korea, 50 000 miners are exposed to coal dust. Inhaling it over a long period can cause serious lung problems.

PNEUMOCONIOSIS

IN SOUTH KOREA

By DENIS MARCHAND

South Korea has massive underground reserves of anthracite, a hard form of non-bituminous coal. As the country's main source of energy, coal is chiefly used in the form of briquettes for domestic cooking and heating. In 1985 total production was expected to reach 22 million tonnes, which places it among the highest in the world.

There are currently 333 coal mines in operation, employing more than 55 000 people. Recent statistics show that 16 percent of the 50 000 miners directly exposed to coal dust are suffering from a debilitating lung disease called pneumoconiosis.

This disturbing situation has induced the Preventive Medicine Department of the Catholic Medical College of Seoul to carry out an in-depth study on the nature, causes and course of this industrial disease. "In a way we are pioneers," says Dr Yun Im Goung, the principal investigator on the research project. "No one in Korea has yet paid any attention to the problem. In 1980 ours was the only hospital diagnosing pneumoconiosis and giving the proper care to people who had it. The medical community was not much aware of industrial disease, and that lack of knowledge made diagnosis difficult or even impossible."

Research has concentrated on 22 mines. Medical examination of their 12 800 miners rapidly revealed 2003 cases of pneumoconiosis, of which 13 were in an advanced stage. Most of the vic-

tims identified worked in places with a very high concentration of coal dust, namely underground at the coal face or in the transportation of the mineral.

Several factors favor the prevalence of this disease in anthracite mines: the friability of the mineral (that is, the ease with which it crumbles), the depth of the pits, the traditional mining methods used, and the poor quality of the work environment.

The coal mined in South Korea is different from the bituminous coal found in Germany, Japan and Canada, which is imported by South Korea for use by its heavy industries such as cement and steel plants. Anthracite is soft and friable and produces a great deal of dust. It is the mineral resource best suited to the manufacture of domestic briquettes. But it is also difficult to apply sophisticated mining techniques to it, according to Hee Bock Eun, a mining engineer. The mining companies use this situation as an excuse for not modernizing their operations.

Coal is extracted with manual tools — hammers, pickaxes, pneumatic drills, and mechanical cutters — in narrow borings which are sometimes as much as 600 metres underground. Overpowering heat and excessive concentrations of dust, which result from inadequate ventilation, make for a harsh work environment — one in which the miners inhale dust.

DEVELOPMENT OF THE DISEASE

The dust deposited in the lung tissues remains there for many years before causing slow deterioration of certain lung functions. Pneumoconiosis is not easy to diagnose and its development can be monitored by radiography only when it has reached an advanced stage.

Symptoms of pneumoconiosis are difficulty in breathing, thick saliva, expectorations (mucous discharge from the lungs) containing blood, persistent cough, and continuous chest pains.

Without proper treatment, there can be serious complications. These include pulmonary emphysema (excessive permanent dilation of the alveolar spaces in the lungs), bronchiectasis (dilation of the bronchial tubes), and perforation of the lungs, all of which involve permanent respiratory difficulties and can even cause death.

The current research project has made it possible to alert many of those involved to the dramatic and burdensome impact of pneumoconiosis on Korean society. It has been a significant tool in the establishment of new preventive medicine programs. At the governmental level, the Ministry of Labour has taken an interest in this research as an aid to formulating new regulations for the health and safety of workers in certain sectors of industry.

Industry management is also trying to tackle this alarming health problem. Several mining companies have modified their systems for air quality control, ventilation, and dust exhaustion, and employees are now given regular medical examinations.

REMARKABLE PROGRESS

"Health in the industrial sector in developing countries is a touchy question," says Dr Yun. "It involves large sums of money

"The dust deposited in the lung tissues remains there for many years before causing slow deterioration of certain lung functions."

which few people are willing to spend. Even so, progress in the area is remarkable and encouraging."

With financial support from IDRC, the Department of Preventive Health has been able to gain relevant knowledge about pneumoconiosis. This is why it has taken on the task of alerting the South Korean medical community which at present is still only slightly aware of the disease although there are now 9000 recorded cases in South Korea.

Since pneumoconiosis is not included in programs of medical studies, specialists from the Catholic Medical Centre are now periodically invited to lecture students and doctors. The publication of their reports is valuable to those who want to know more about it. There are now seven hospitals throughout the country which pay special attention to the disease and can provide appropriate care.

"It isn't possible to change everything

quickly," Dr Yun says. "We have managed to awaken the interest of many people, and that's important. We have gone a long way in a few years with much patience. Our task is not finished."

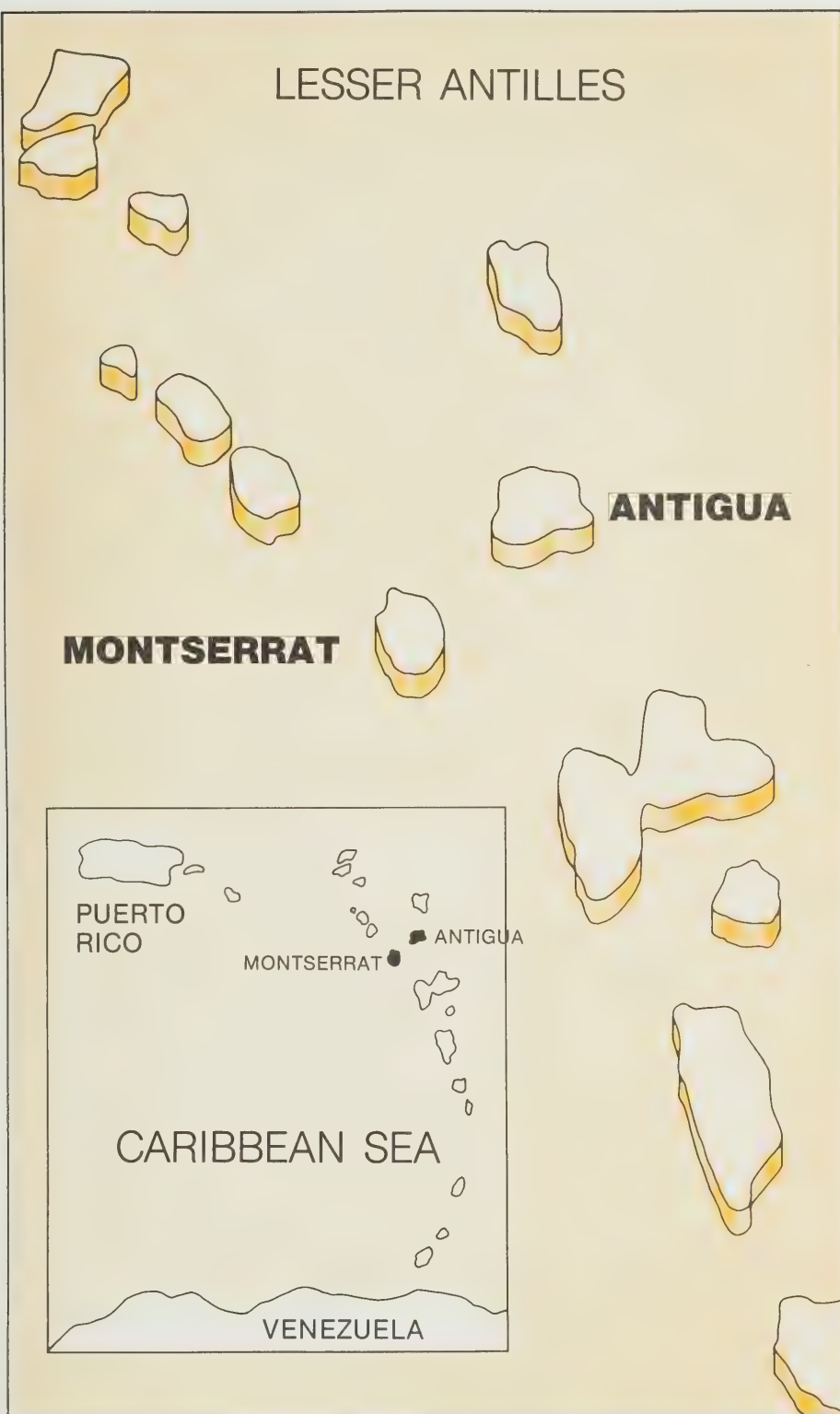
South Korea is currently experiencing phenomenal industrial growth. The country is the second largest exporter of ships in the world and the 13th largest producer of steel with recorded exports of over US\$2 billion. Unfortunately, industrial diseases are growing at a corresponding rate. The Catholic Medical Centre, therefore, hopes to continue with its research, particularly in the shipbuilding yards where there is a high rate of lung disease. □

Denis Marchand is a freelance journalist from Richmond, Quebec, Canada. He recently toured Asia as part of a project of the Fédération professionnelle des journalistes du Québec, supported by the Canadian International Development Agency (CIDA).



Photo: Denis Marchand

A mobile X-ray service has made it possible to give preventative lung examinations to thousands of miners.



FARMING IN THE CARIBBEAN

LAND REFORM IS NOT ENOUGH

By FRANK A. CAMPBELL

An Antiguan farmer put it this way: "Just giving a man a piece of land and not providing other facilities like water... I think farmers will still find themselves in a lot of trouble." These words summarize some recent research findings on Caribbean land tenure.

The researchers to whom the farmer's opinion was directed were trying to discover the actual and potential impact of land reform in Antigua and Montserrat on agricultural and, generally, economic development. The research conducted by the Faculty of Law of the University of the West Indies (UWI), Jamaica, and funded by IDRC suggested that the security of tenure available to farmers through government land settlement schemes was not sufficient to maximize such development.

According to the research team headed by Caribbean land law expert Dr Nick Liverpool, the situation is disappointing. "The existing land settlement schemes do not and indeed cannot achieve those objects of modern economic uplifting in their present form." But the situation is also encouraging, according to Dr Liverpool, "because the scope for innovation, improvement, and modernization is so easily within the reach of the Governments... if only they were willing to take advantage of the general desire for reform since most of the agricultural land in both countries is owned by government."

NO PRODUCTIVITY DIFFERENCE

Of the general desire and need to reform agriculture in these and other Commonwealth Caribbean countries there can be no doubt. Montserrat's 12 000 and Antigua's 76 000 people, notwithstanding their growing tourist and fledgling industrial sectors, depend on agriculture for national survival and growth.

Government ownership of most of the

agricultural lands in Antigua and Montserrat results from the collapse of the previously dominant sugar and cotton enterprises respectively. Through the division and distribution of the former sugar and cotton plantations, the two governments hoped to mobilize local farmers to take over where the producers of these two crops had left off.

Dr Liverpool, together with social scientists Dr Patrick Emmanuel and Dr Christine Barrow and with the assistance of statistician Eric Armstrong, tried to find out the extent to which these hopes were being realized. Has there been, for example, any increase in the size or improvement in the soil quality of small farms? Two survey teams — headed by former Agriculture Minister Franklyn Margetson, in Montserrat, and Senior Agricultural Officer McKenzie Harper, in Antigua — asked 300 farmers and a number of agricultural officials. The questionnaires from this survey, plus literature reviews and other work by the principal investigators and the statistician, provide some tentative answers.

The researchers find no evidence that productivity differs between government land settlement schemes and other farms. However, the majority of farmers, especially in Antigua, believe the former arrangement provides greater security of tenure.

This greater feeling of security is apparently founded in the belief that governments are unlikely to risk political fallout by evicting farmers. Formal leases or other written titles are rare in both systems. "Of the 175 plots on settlement lands in Antigua," the research team observes, "written agreements were given for only 13... compared with 9 plots of 65 in Montserrat. With respect to private lands there was only one plot with a written agreement out of 38 plots in Antigua and one plot out of 69... in Montserrat."

NO LAND HUNGER

Concerning soil quality there was some difference in perception between Montserratian and Antiguan farmers, but little between settlement and non-settlement farmers. The Antiguan farmers thought the soil on all but 17 of their 217 plots to be "fair to good" or "very good". The Montserratian farmers, however, believed more than half of their plots were "so, so", "poor" or, in one case, "very poor". Montserrat is more mountainous than Antigua.

Farms continue to be quite small. More than 75 percent and 85 percent of the plots in the Antiguan and Montserratian samples respectively were less than four acres. (The average Canadian farm in 1981 was more than 490 acres.) Notwithstanding Montserrat's policy of "economic-size farms", over 45 percent of the plots in the Montserratian sample were less than one acre compared with 5.8 percent in Antigua's case. However, in Montserrat, government-owned plots are larger than private ones.

In spite of the persistence of the mini-farm and the proliferation of verbal rental agreements, farmers ranked "insecurity of tenure", "unavailability of land", and "problems with lease/rental agreement" respectively as the eighth, fourteenth and fifteenth (and least) most important of their

problems. In Antigua, home of 200 of the 300 farmers interviewed, non-settlement farmers were more worried than settlement farmers about security of tenure. The situation was the reverse in Montserrat. On both islands, however, the vast majority of farmers on land settlement schemes prefer to own their farms rather than remain tenants of the government.

Despite the apparent absence of land hunger among the farmers, Dr Liverpool feels that farm size is a problem, especially for more enterprising farmers. "After a while," he said, "two or three acres become insufficient."

NO AGRICULTURAL TAKE-OFF

Whatever the various views about security of tenure or farm size, land reform in these two territories has not produced the needed new agricultural take-off. "While it is clear," say the researchers, "that access to land and security of tenure are important prerequisites for agricultural production, they are by no means the only ones."

This is exactly the point made by the Antiguan farmer quoted earlier! Crop damage by untethered livestock and poor arrangements for irrigation, marketing, credit and input are among the farmers' problems.

That half of all small farmers do other jobs and that the average farmer earns less than a construction labourer reflect the problems facing the sector. Another symptom, and result, of the countries' agricultural problems is the avoidance of farm-

"While it is clear that access to land and security of tenure are important prerequisites for agricultural production, they are by no means the only ones."

ing careers by young men and, more so, by young women. Two of every three farmers are over 50 years old, and fewer than 15 percent are under 30. Yet, the majority of the older farmers interviewed started farming in their twenties or earlier.

STRAY ANIMALS

The livestock problem has been rated number one by farmers in Montserrat where beef production is encouraged. Antiguan farmers rate this problem second. Both countries have laws against strays. However, the legal remedies have been ineffective. There is no easy solution to this problem as to whether "the livestock farmer should fence his animals in or the vegetable farmer fence them out", as a

Montserratian agricultural officer put it.

Irrigation is problem number two for Montserrat's farmers but number one among the Antiguan whose rainfall is inadequate, irregular and badly distributed. An estimated 90 to 95 percent of Antiguan farmers and 98.4 percent of the cultivated land are without irrigation water. "When it rains the farmers rush to plant, all at the same time," according to an extension officer.

The researchers have referred to the poor marketing arrangements in both territories. "Farmers complain," they say, "of having to spend time 'running about the place' looking for markets and occasionally having to plough back their produce or dispose of it cheaply as pig food."

Government agricultural marketing bodies face gluts, spoilage, and insecure domestic and international markets. They lose money, although market guarantees partly explain Montserrat's 10-fold food production increase between 1971 and 1975. Farmers are angry over the importation of foods which can be produced locally. They allege an apparent preference for such imports in the tourist sector. According to Dr Liverpool, these marketing problems have led many Caribbean farmers to concentrate on a few "safe crops" such as banana and nutmeg for which there are more or less guaranteed export markets.

The researchers have done more than identify problems. In marketing, they recommend effective government guarantees for a wide range of farm products, including livestock. They propose import bans on locally available food items and contracts with local hotels, but note that "much depends on the expansion and reliability of intra-regional markets and the accompanying facilities of transport and storage."

They recommend written leases and rental agreements and the payment of rents retroactively rather than in advance. Higher pound fees, better credit arrangements, and an end to the splitting of small farm plots among heirs of deceased farmers are other recommendations. The team also points to the need for further research, especially on marketing.

The researchers hope to have their findings discussed at a special conference of agricultural officers, planners, policy-makers and farmers. Dr Liverpool believes Caribbean leaders wish to solve the problems. He offers as evidence Antiguan Prime Minister Vere Bird's ready agreement to accord him an interview and the St Lucian government's implementation of a recommendation by an earlier study team, which included Dr Liverpool, to conduct a cadastral survey of the country.

Money is likely to be the major obstacle preventing the governments from implementing the findings of the IDRC-supported UWI study. But Dr Liverpool and his fellow researchers remain hopeful. "We would like to see the results of our research influence the lives of people." □

Frank Campbell, a Guyanese journalist and ex-diplomat, writes regularly on Caribbean and international issues.

The sun has only just begun the second part of its daily trajectory through the skies above the little Senegalese village of N'Goundiane, about 100 km east of the capital, Dakar.

In the shade of the 'talking tree' a man of about 50 recounts a story. One day some years ago, his 10 year-old-son suddenly found himself at the bottom of a cesspool because the flooring above it had given way beneath the child's weight. Built in a thoroughly home-made way, and not meeting any kind of safety standards, Mr NDiouga Faye's latrine was the first one ever built in N'Goundiane.

This episode, from which the child emerged unscathed, resulted in the villagers becoming even more skeptical about the advantages of fitting their homes with such equipment. NDiouga didn't hesitate for a moment, however, before building another latrine, and two or three other block chiefs followed his lead.

These three or four latrines initially had no impact on the habits of the villagers, who continued to withdraw some distance from the village every time nature called. But even this traditional system was not without drama, particularly for the adults who, in full view of their children, regularly had to retreat to 'hidden places'. In an environment where custom endows adults with a certain mystique entitling them to the respect of youth, it is quite embarrassing to be observed going off to relieve one's biological needs. What's more, the lack of vegetation around the village due to drought and deforestation forced the adults to withdraw even further, so as not to be seen undressing.

As for the children, they relieved themselves whenever and wherever the need struck them. Consequently the danger from excrement was constant. The result was epidemics and deadly cases of diarrhea, particularly among children.

DIARRHEA: A KILLER

The International Children's Centre is located at Khombole, the administrative centre of the communal area, 46 km from N'Goundiane. The Centre is responsible for the supervision of sanitation in the area and its statistics show that disease, with diarrhea at the head of the list, kills more than half of each generation of children before the age of five.

Nowadays diarrhea still kills in N'Goundiane, but excrement is not the sole cause. Latrines have arrived in the village, and in several concessions, the 'hidden places' away from the houses are no more than a bad memory. Since October 1984, 80 latrines have been put into service in N'Goundiane, built with funding from IDRC.

The project began in 1983 and the initial program called for the construction of latrines, 10 pits for burning refuse, and the rebuilding of the village's five traditional wells.

When one takes stock of the work, it is easy to see that not everything has

THE LATRINE COMES TO N'GOUNDIANE

By IBRAHIMA BAKHOUM

been done, even if the main goals seem to have been achieved. Only five of the 10 pits planned for the burning of refuse have been built, and nothing has been done about restoring the wells.

RIISING COSTS

The Director of the National School of Sanitary Engineering at Khombole, who is responsible for executing the project, explains that this situation results from the prices of building materials becoming inflated. The cost of iron, cement and canvas went up between the time the project was planned and

"The lack of vegetation around the village due to drought and deforestation forced the adults to withdraw even further, so as not to be seen undressing."

the implementation phase, which meant that the budget could not cover the all the planned purchases. However, the equipment that was installed does not seem to justify the amount budgeted, the cost per unit being very high compared to what it has been possible to do in other village projects. Still, opting for latrines to the detriment of the wells turned out to be the best choice since the village now has a bore-hole which has made people forget about traditional water sources.

As for the burning pits, the villagers seem to have only a theoretical understanding of their use. Designed to receive light domestic refuse, the pits are equipped with a grill halfway down that collects the ashes for later use as fertilizer in the fields. All those asked about this recited their lesson perfectly, but the pits remain unused and the grill has even disappeared from one of them.

Such a lack of interest can be explained by several hypotheses. The vil-

lagers claim they were never told they could use them. However, Abdoulaye N'Doye, the workman who built them, continues to say that the green light for their use was well and truly given.

A second hypothesis is based on the fact that household refuse has never really been a problem in the village. So far there is no industrial waste produced in this environment. It is mainly animal excrement from stables and pens which has to be disposed of and it is generally sent out to the fields as manure.

Lastly, everything leads one to suppose that what has often happened in other villages has also occurred in N'Goundiane: the local population wasn't consulted as to what kind of equipment they felt best suited their needs. No one here remembers ever having attended an information meeting. The team of experts only visited the village once to announce that latrines would be built there.

SETTING A TREND

It is obvious, however, that the inhabitants of N'Goundiane are thoroughly satisfied with the project. When the author went there to gather information for this article, all those who hastened to meet him in the village square couldn't find adequate words to express their feelings of satisfaction and gratitude.

Those who at first held back because they doubted the outcome of the project are now pressing the head of the village to give them priority on a new list of participants, in anticipation of a possible second operation of the same kind. With 80 latrines for a population of 3000, pressure on the facilities is still very heavy.

But a second phase might not serve any purpose because the project has already started a trend — some of the villages are now thinking of building their own sanitary equipment. And nowadays the only reason that anyone in N'Goundiane remembers the fate that befell NDiouga Faye's son is to show the importance of properly built latrines. □

Ibrahima Bakhoum is a journalist with the Senegalese Press Agency (APS).

GLOBAL PATTERNS OF MIGRATION

WORKERS ON THE MOVE

By ANDRÉ McNICOLL



In Latin America, Mexico City is a favorite destination of migrants.

When Asian tribes crossed the frozen Bering Strait in search of food some 20 000 years ago and settled across the Americas as far south as Tierra del Fuego, they embarked on one of the most remarkable migrations in human history. But it was neither the first nor the last such massive demographic shift.

It is wrong to assume, as many anthropologists do, that we are either nomads or settled agriculturalists. Subject to pressure, we can all pack up and move — sometimes awesome distances — and have been doing so ever since we started to hunt and fish for our survival. Population patterns around the globe have been and continue to be shaped largely by one inescapable imperative: the need for food and shelter.

Over the centuries, as survival turned into an economic activity, the most important form of demographic dislocation has been labour migration. Labour for hire, labour for sale is now an integral feature of the global economic system. Since the Industrial Revolution, when economically motivated migration clearly displaced religious and political migrations in importance, there has evolved an international division of labour — largely unstated — which shifts as it responds to major changes in technology and the variable needs of transnational capitalist interests.

The most dramatic example of international labour migration today is in the countries of the Middle East where the near quadrupling of oil prices between



A market in Addis Ababa, Ethiopia. Africa, Asia and Latin America have "armies" of under-educated and unemployed workers.

October 1973 and January 1975 triggered frantic economic and social development. With a small indigenous population base, low labour force participation, especially by women, and underdeveloped educational resources, these countries had to rely heavily on foreign labour to implement their ambitious plans.

By 1980 there were 2.7 million immi-

grant workers in the oil-exporting countries of the Middle East and North Africa — Algeria, Bahrain, Iran, Iraq, Kuwait, Libya, Oman, Saudi Arabia, and the United Arab Emirates. Although the total number of people involved is small compared to previous waves of labour migration (whether forced or voluntary), it is substantial when considered as a proportion of the whole labour force. As early as 1975 the share of immigrant labour in total employment in the United Arab Emirates was 89 percent, in Qatar 83 percent, in Kuwait 71 percent, in Oman and Saudi Arabia 39 percent.

There is a tendency to see the situation in the Middle East as temporary, that someday the millions of migrant mechanics, farm labourers and technicians will return to their native villages and towns and leave nothing behind but roads and bridges, oil and sewer pipes. This may happen, but labour migration in the past has often resulted in permanent demographic changes of great magnitude.

THE AMERICAS

From the 16th to the middle of the 19th century, 15 to 30 million Africans were shipped as slaves to the American continent. By 1840, in the British Caribbean, slaves comprised 70 to 75 percent of the total population. Later, when slavery was abolished, the importation of indentured labour resulted in millions of Indians, Chinese, Pakistanis and Malays settling permanently in the colonies. This guaranteed the sectioning off of underdeveloped nations into specialized producers of cereals, meat, coffee, cocoa, fruits, and, later, oil for the benefit of imperial coffers.

Substantial international labour migration is normally associated with the middle stage of industrialization when a country's economy is expanding. Technical resources are modest and there is a need for a large but relatively unskilled labour force to clear land for agriculture and to build mines, roads, railways, and a physical infrastructure in urban areas. This was very much the case with both Canada and the United States from the middle of the 19th century until well into the present century. Following the importation of Chinese labourers to help build the railroads across the vast prairies and the far West of North America in the 1850s, there came millions of immigrants from Western, Central, and Eastern Europe. Many came from the British Isles where the growth of capitalism, population

increase, and the crop failure enclosure acts, which turned common lands into private cultivable land, precipitated migration overseas. Between 1904 and 1914 alone, fully 10 million people migrated from Europe to the United States. This particular example of migration has been seen by students of demography and geography as evidence that labour migration cannot be understood without reference to the internal and external dynamics of the world capitalist system.

ARMIES OF UNEMPLOYED

The pivotal variable shaping current patterns of capital expansion is now considered to be the existence of "armies" of under-educated and unemployed workers in Africa, Asia, and Latin America. This huge, potential labour force is helping enforce a new international division of labour and capital flow characterized by rapid industrial relocation of manufacturing operations.

According to the International Labour Organization (ILO), there are now more than 200 million 12- to 17-year-olds out of school in the developing countries — 137 million in Asia, 45 million in Africa, and 19 million in Latin America. Most of them have either never been to school or have less than a grade 4 education, and live in rural and poor urban areas. The Third World labour force in the 15 to 24 age group, now numbering 338 million, will increase to 467 million by the year 2000. This means that developing countries have the formidable task of creating well over 100 million jobs to absorb new entrants to the labour market and an additional 35 million jobs for the present jobless youth.

WORLDWIDE PHENOMENON

International labour migration is a significant demographic feature in several regions of the world. In Western Europe there has been a strong migratory tradition for centuries, abetted in part by political liberalism which facilitated the free movement of people across state boundaries, and by associations with former colonies. Since 1945 migratory flows have been principally from the Mediterranean Basin and North Africa to the industrial economies of the Northwest. In 1973 France and West Germany each had some 2.5 million foreign workers, accounting for 10 to 12 percent of their labour forces. Switzerland had 600 000 (30 percent); Belgium and Sweden each had between 200 000 and 220 000 (6-7 percent); the Netherlands had 80 000 (2 percent); and Luxembourg had 33 000 (30 percent).

Until the 1930s there were significant migratory flows from Europe to Latin America, mainly to Argentina, Brazil, and Venezuela. Between 1857 and 1930, Argentina received 6.3 million overseas migrants. By the 1950s, though, international labour migration had been replaced by intraregional flows affecting very large numbers of workers. The Southern Cone (Argentina, part of Brazil, Bolivia, Chile, Paraguay, and Uruguay) has been particularly

prone to labour migration involving mainly manual workers from rural areas. Between 1950 and 1974, Argentina experienced a net migratory flow of over one million people from its Southern Cone neighbours, with foreign-born workers eventually accounting for 14 percent of the country's labour force.

West Africa has also experienced intensive intraregional labour migration. Workers from Guinea, Mali, and Burkina Faso seek higher wages in Ghana, Ivory Coast, and Senegal. In Ivory Coast, a country where wages, in even the poorest regions, are higher than anywhere in Burkina Faso, fully 20 percent of workers are foreign born.

FROM EAST ASIA TO MIDDLE EAST

But it is the situation in the Middle East that attracts attention and is now the focus of much research, particularly

"Substantial international labour migration is normally associated with the middle stage of industrialization when a country's economy is expanding."

as concerns the impact of remittances on sending countries. In 1975, 58 percent of foreign workers in the oil-exporting countries of the region came from other Arab states. After 1975 there was a dramatic increase in the number of workers from East Asian countries such as South Korea, the Philippines, and Thailand. These countries boosted their labour exports by using national contracting firms who bought the labour component of large projects, established work camps, and provided most of the basic services such as housing, utilities, and health services, thereby considerably cutting costs for receiving countries. Estimates are that by 1982 there were 500 000 Filipinos, 200 000 Koreans, and 200 000 Thais working in the Middle East.

Most Asian governments encourage the export of labour, seeing it as a way to reduce national unemployment, a source of foreign exchange, and a means of improving the standard of living of affected families through better nutritional intake, better clothing, housing, and schooling for children. The effects on sending countries depend on many factors, such as magnitude of outflows, employment and occupational status of migrants before they leave, proportion of remittances to income, use made of remittances, extent of

increase in the skill levels of the returned migrants, and stability of the labour export market.

Certainly, sending countries can be negatively affected. Some become too dependent on remittances and therefore vulnerable to outside economic factors. Some lose too many workers themselves. Jordan, for instance, experienced a serious shortage of skilled labour after 1975, threatening the implementation of its own development plans. Tunisia, which has only some 2500 skilled workers abroad, is nonetheless now very short of teachers of mathematics, sciences, and languages. Some workers return and end up poor, spending their money on consumer goods such as television sets and cars.

BRAIN DRAIN

IDRC has been funding a series of projects to look at the consequences of labour exportation on sending countries. Studies have already focused on the effects of the "brain drain" in the Caribbean and Tunisia. Others are planned in Guyana, Surinam, and Argentina. In the Philippines, project support will help the Institute of Labour and Manpower Studies look at the range of possible impacts of exported contract labour at the individual, household, and community levels.

Indonesia, which in the period 1969-1974 had only 5500 nationals working abroad, has formulated an ambitious plan to have 300 000 workers outside the country in the period 1984-1989. It is expected they would generate almost US\$2 billion per year in remittances. IDRC support will enable the Atma Jaya Foundation in Jakarta to gather in-depth data on temporary labour migration from Indonesia to the Middle East. Indonesian planners, though wishing to stimulate labour migration, do not wish to experience the negative effects of a brain drain. The country is already losing too many physicians and teachers to Sarawak and the Malaysian mainland.

Another project, in this loose and informal Southeast Asian network, will describe the process of migration to the Middle East from rural areas of Thailand. Of particular interest will be the effect of labour loss on agricultural production.

Migration has existed from the dawn of history. But we no longer have vast hunting and fishing grounds to serve as a refuge for roaming bands fleeing from hunger, or virgin lands to be settled by millions of disenfranchised peasants and urban poor, or weak and sparsely populated nations open to permanent demographic transformation from military conquests. Today migration is largely a legal matter, a contractual affair modulated according to economic interests. Whether a nation sends or receives labour migrants, it must have a clear notion of the consequences. □

André McNicoll was formerly senior writer at IDRC.



Photo: Laurell Waddell

Improper bandaging of burns can result in deformities or loss of limbs.

CANADIANS IN LESOTHO

HEALING HANDS

By ANNE FISHER

"I had intended to visit a number of villages, accompanying the flying doctor. During my first week, though, he sent me on my own to a village in the mountains. The clinic consisted of a small hut without electricity or water. The people could not speak English and I could not speak Sesotho. We worked through a public health nurse who could speak both languages, although her knowledge of English was limited. At that point I had not completed my training in obstetrics, gynecology or surgery, but was expected to see patients with problems in those areas — that included making the diagnosis and prescribing appropriate treatment.

"There were about 120 patients waiting to be seen in a four-hour period. Many of them had walked long distances to see the doctor who visited that clinic only every six to eight weeks. I was able to see 40 patients during the four hours; the remaining 80 had to return to their homes unattended."

As these words of Canadian medical student David Kuhl suggest, it was quite an

experience for him, his wife, Jean, and friend Laurell Waddell, to spend two months last year in Lesotho, a poor, tiny country surrounded by South Africa.

Waddell and Jean Kuhl are both Canadian occupational therapists with an interest in the problems of burn victims. David Kuhl is an epidemiologist. The three were financed by a Young Canadian Researchers award from IDRC (see box) to investigate the causes and treatment of burns in Lesotho and to help train the medical staff there.

"Before we went," said Waddell, "we contacted the head physiotherapist in Lesotho and asked what was needed so we could come prepared." The three collected donations (more than \$5000 worth in money and supplies) from friends, church groups, and private firms. They left Canada with a two-year supply of thermoplastic splints and elastic material for pressure garments used to treat burns. They also had enough money to buy a refrigerator for

the Queen Elizabeth II Hospital, in the capital city of Maseru, which is Lesotho's main medical facility.

The two women concentrated on training medical personnel — village workers, nurses and therapists — in the prevention of scars and contractures to avoid later disability of burn victims. David Kuhl was to assist an intern on the men's ward. Shortly after he arrived, the intern resigned and left David responsible for the ward. As often happens in situations where the community's medical needs exceed the human resources available, he did not have as much time as he had hoped to devote to his planned research: a study on the causes of burn accidents in the country. He was too busy helping the sick and injured.

COMPUTER BUT NO FRIDGE

Although the hospital did not have a refrigerator to store medicines, it did have a computer for training visually impaired adults. The computer had been donated to the hospital, but no one at the hospital

knew how to use it. Jean Kuhl did, and she trained the doctor and staff.

Mountainous Lesotho, with a population of only 1.5 million, is one of the world's 10 poorest countries and has a cold winter. Open fires are built in depressions in the dirt floors of one-room huts and small children are often burnt severely by falling into the fire. In summer, some people use three-legged, single-burner paraffin stoves supporting huge cooking pots. These burners are usually placed unshielded on the floor and children sometimes knock against them, bringing the scalding cauldron down on top of them.

Waddell worked in the main hospital, a district clinic, and several "peripheral clinics" like the one David Kuhl visited in his first week. "One day alone, we helped treat five children with hand burns, and most had lost fingers," she recalled. In one case, a three-year-old child had been huddling with other children around the home fire when the blanket she was wrapped in caught fire.

PREVENTIVE MEASURES

After seeing several children with similar stories, Waddell said she had to resist the impulse to visit villages to try to convince people to use clay stoves, which are safer. She knew that people do not change traditional cooking and heating practices over night and that the community health care workers, especially those who go far into the countryside on horseback, have the best chance of influencing the rural people. Rather, she talked to the trained community health care workers about preventive measures — such as using stone or metal guards around the open fires and burners.

If severe burns are not treated correctly, they often cause permanent disuse of limbs and fingers because the tendons and skin contract during healing. "Everybody's automatic response," said Waddell, "is to keep an injured limb bent." In fact, a burned limb

"Hand injuries were particularly common and children had been losing fingers because of incorrect bandaging."



Occupational therapist Jean Kuhl instructs a medical worker in the proper care of burns.

must be kept straight with a splint to prevent joints from healing in a deformed way. Hand injuries were particularly common and children had been losing fingers because of incorrect bandaging. If a burned hand is wrapped with the dressing acting as a mitt, tendons may become useless. The fingers are unable to straighten and the opposing function of the thumb

may be lost. For the patient to regain full use of the fingers, each finger must be splinted and wrapped separately and the thumb must be separated from the fingers by a pad.

Burn dressings must be soaked before they are removed or the newly healed skin will be pulled off with the dressing. But in Lesotho it was common practice to rip burn dressings off dry. The workshops given by Waddell and Jean Kuhl helped to correct such practices.

The three Canadians are back in Canada now, pursuing their careers and preparing themselves for another, longer stay in Lesotho or some other country where they can be of help. They have undoubtedly changed the methods used for treating burns and training the visually impaired in Lesotho, but what each of them stressed in the final reports to IDRC was how much they had learned from their experience in Lesotho. "The trip was an exciting and invaluable experience," said Waddell. "It gave me a renewed appreciation of the luxury medicine we're able to practise here in Canada." □

Anne Fisher is a freelance science writer.

A RESEARCH PROGRAM FOR THE YOUNG

The Young Canadian Researchers Awards were introduced by IDRC in 1982 as a way to increase the pool of Canadians qualified to make a contribution to Third World development in the realm of science and technology.

It is widely recognized that foreign "experts" are of more use to developing countries if they are first sensitized to the unique conditions — historical, cultural, social, and technological — of the country that will benefit from their work. A major component of the Young Canadian Researchers awards program, then, is the placement of the successful candidates in a research or training institution in a developing country for up to one year.

Canadian Doctoral students registered in a Canadian University are eligible if their studies are in: agriculture, food and nutrition sciences; communications; health sciences; information sciences; social sciences; energy; or earth sciences. For students at the Master's level, the eligible fields of study are health sciences; journalism; finance; and administration. Award winners are chosen through open competition.

Under the Young Canadian Researchers program, a successful candidate's work consists of field research, placement

or formal training, depending on the level and field of study. Master's level awardees in health sciences may conduct their research or follow a training program in a developed country if the host institution there offers a program oriented toward developing countries.

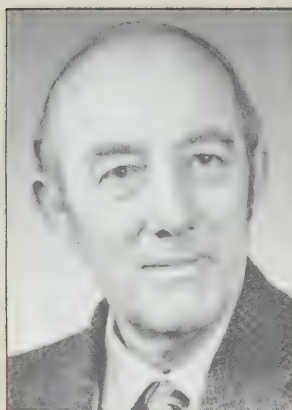
Why does IDRC have such a program? As a development agency, the Centre has always concentrated its efforts on building Third World research capacity — not Canadian. Developing country researchers are given financial support and advice to design and execute relevant research projects themselves. But IDRC also recognizes that Canadians have much expertise to offer directly to developing countries.

In 1980, IDRC set up its Cooperative Programs as the main tool for harnessing that Canadian know-how. That division brings together and supports highly qualified Canadian scientists and their counterparts in developing countries to work jointly on problems of concern to the latter. The Young Canadian Researchers award program, though accounting for only a small part of IDRC's budget, is intended to complement that cooperative stream in IDRC's work.

SORGHUM

THE STRUGGLE FOR ACCEPTANCE

By ANNE FISHER



Dr Hugh Doggett

Dr Hugh Doggett, botanist and world authority on sorghum, retired in 1985 after being associated with IDRC's Agriculture, Food and Nutrition Sciences Division for more than 14 years. In this article, based on an interview with Dr Doggett, freelance writer and former cash crop farmer Anne Fisher examines the problems of sorghum production and the potential for Africa of this traditional drought-resistant food grain.

"In 1946, when I was appointed a government botanist in Tanzania, there were three people working on cotton at my research station and probably three times that many in the country, and six to eight times that many in East Africa. But nobody seemed to be paying much attention to sorghum and it was very widely grown in that area. So I worked on sorghum from Saturday to Thursday and rice on Fridays."

Many African and Indian botanists will recognize the speaker as Dr Hugh Doggett, a man who has quietly devoted much of his life to improving one of the most important staple food crops of the semi-arid areas of Africa and India. Doggett's work in Tanzania led him to concentrate on sorghum during the 11 years he was a plant breeder for the East African Agriculture and Forestry Research Organization at Serere, Uganda. His keen interest continued during

his tenure as Associate Director responsible for the plant sciences program at IDRC, and when he was seconded to ICRISAT from 1973 to 1976, he initiated the sorghum and millet research program there.

THAT OLD-FASHIONED CROP

Some would argue that the efforts of Hugh Doggett and others have been wasted, that sorghum is a crop of the past, replaced by rice and corn, the new crops of Africa. But as both population density and the area affected by drought grows, sorghum, the traditional crop of last resort, becomes once again an important staple food. Doggett says that when ICRISAT wanted to open a sorghum research station in Kenya, the Kenyans weren't interested in that old-fashioned crop. But today sorghum is still grown in Kenya and is becoming increasingly important as popu-

lation pressure forces more farmers to exploit the marginal semi-arid regions.

Sorghum and millet are hard, tough-hulled cereals that require arduous preparation to make them edible. Village women must spend a few hours each day pounding the grain in a traditional mortar with a pestle. In Ethiopia and Sudan, the ground flour is made into a batter and fermented for a day or two before it is cooked as patties. Babies are commonly weaned on "nasha", a sorghum gruel that is fermented before it is cooked.

In Kenya and Senegal, the grain is germinated and/or treated with wood ash before it is ground. In other areas, a thin porridge, ugali, is made by mixing sorghum flour with boiling water and lime juice. And in much of Africa, the red sorghums are used for making beer.

The fermentation, germination, alkaline and acid treatments are all ingenious traditional methods that increase both the palatability and digestibility of sorghum. But they are a lot of work and sorghum has become a poor man's crop, spurned by city folk and others who can afford to eat rice or corn.

Doggett says that another reason sorghum has never made its mark on the commercial markets of Africa is that maize was encouraged by the colonial administrations because it was easy to prepare for institutional use — in prisons, schools and work camps. A cash market was therefore established for maize, but sorghum has remained within the informal economy.

SORGHUM BECOMING MORE POPULAR IN LATIN AMERICA

The switch in Africa from sorghum to corn is being reversed in Latin America, Doggett says. Some of the old African food varieties are still grown in Honduras, presumably brought there by Africans brought in for slave labour. But now, new varieties of sorghum are being grown in areas of South and Central America that are too dry for reliable harvest of maize. Some strains were imported from the US to produce cattle feed and, partly with IDRC support, some cold-resistant varieties have been developed in Mexico from the white- and yellow-grained food varieties traditionally grown in Africa. Since the mid-1960s, sorghum production has doubled and tripled in many countries of Latin America. "It's all part of the process of getting the best crops for each location," says Doggett.

Within a decade of their introduction,



Farmers prefer sorghum with long stalks because they can be used as fodder or for construction.



new high-yield varieties of wheat virtually replaced traditional varieties in India. In Indonesia, as in other areas of Asia, 80 percent of rice now grown is improved varieties. But with sorghum in Africa, this kind of revolution has not occurred. In 1984, the World Bank stated: "No major breakthrough has been achieved in genetic improvement of rainfed sorghum and millet, which account for 80 percent of the cultivated land of the Sahel and other areas of low rainfall. Nor can rapid progress be expected."

Doggett says that it is hard to quantify the adoption rate of new varieties in Africa "because there is no seed industry" and

"Nobody seemed to be paying much attention to sorghum.... So I worked on sorghum from Saturday to Thursday and rice on Fridays."

because sorghum rarely reaches the formal economy. He estimates that the new strains are gaining ground but have not replaced traditional varieties to any large extent, partly because "we need better ones".

DROUGHT RESISTANCE DIFFICULT TO BREED

Sorghum had been neglected by researchers because it was mainly a subsistence crop, grown by small farmers for their own consumption. Not only was the crop not important in terms of market statistics, but the fact that it was not commonly sold for cash meant that farmers could not easily improve yields using high-cost inputs of fertilizers and pesticides because they lacked money. In addition, the crop's most important attribute, its drought resistance, is a characteristic for which it is difficult to breed.

In the United States and in Latin America, sorghum is grown for cattle feed. New varieties, grown with the aid of chemical fertilizers and irrigation, commonly yield five times more per hectare in the US than in Africa. But the results of American research cannot be transferred directly to Africa because the new strains are not resistant to African pests and diseases, would require irrigation, and have been developed for cattle feed, not for the tastes of African consumers. As Doggett says, "The importance of quality and consumer preference is too often ignored. It is hard for those of us who hear of famine to think that quality is as important as quantity or protein content."

Traditional African sorghums vary from the light-grained food types used for porridge, patties, hoppers and nan, to the red, brown and black types commonly used for



Sorghum is a reliable friend of farmers in the semi-arid tropics.

brewing. Sorghum, especially the darker varieties, contains high levels of polyphenols or tannins. Although tannins inhibit protein synthesis in mammals, they also discourage quelea birds, huge colonies of which destroy entire grain fields. Pre-cooking treatments with lime, wood ash or fermentation serve to deactivate the polyphenols and increase the digestibility of the protein.

To increase the consumer demand for sorghum, IDRC funded research at the Centre national de recherches agronomi-

control of this weed.

One major advance in plant breeding, including sorghum breeding, is the elimination of photosensitivity. Once the timing of maturity is divorced from day length, short-season varieties can be developed. In the case of semi-arid areas, this allows the crop to mature during the rainy season.

Traditional sorghums mature after the rainy season. As long as there is enough residual moisture left in the ground, this works well. But if the rains have been lighter than usual, there may not be enough moisture for the grain to fill out and yield well. Short-season sorghum would, in theory, take fullest advantage of any available rain. But sorghum is susceptible to molds which damage the grain. If strains that mature during the rainy season are to be successful, Doggett says, they must be resistant to such attacks.

Short-season varieties are also short-stalked so that more of the plant's resources go into the grain rather than leaves and stem. This sounds good in theory, but in fact, farmers tend to prefer the tall varieties because the stems and leaves can be used as fodder or building material.

For sorghum to continue to be planted by increasingly commercialized farmers, new post-harvest processing techniques are essential. In this regard, IDRC has been helping several African nations to develop and build mechanical dehullers and grinding mills for sorghum and millet.

If the yield reducers can be beaten and the consumer demand for sorghum increased, the crop will continue to play an important role in smallholder agriculture in the arid areas of India and Africa. Sorghum and millet, being the most drought-resistant staple food crops, are thought to have the best potential to ensure stable, self-sufficient food production in many of the countries facing massive food shortages today. □

"The importance of quality and consumer preference is too often ignored. It is hard for those of us who hear of famine to think that quality is as important as quantity or protein content."

ques (CNRA) in Senegal to develop varieties low in polyphenol, suitable for regions which are not afflicted with a bird problem.

CONTROLLING STRIGA

Aside from quelea birds, Doggett says that the main yield reducer of sorghum for the smallholder in Africa is the prolific parasitic weed striga (witchweed). It is almost impossible to control mechanically and few sorghum farmers can afford chemical control. IDRC is supporting research on the



A brewery worker in La Paz, Bolivia. As in the industrialized nations, the production and sale of alcohol in the Third World is a lucrative enterprise.

ALCOHOL IN THE THIRD WORLD

THE CUP RUNNETH OVER

By JACQUES DUPONT

Every specialist queried on the subject agreed that the figures are horrifying. Just recently the World Health Organization (WHO) confirmed what can be directly observed in the shanty towns of Latin America, Southeast Asia, and Africa. From 1965 to 1980, the production of alcohol increased by 50 percent in the developing countries, which appears to be leading to a rapid rise in alcoholism.

"What we are seeing is the standardization of personal habits," says David Archibald, chairman of the International Council on Alcohol and Addictions (ICAA), based in Geneva, of which 130 countries are members. Archibald, who is also one of the founders of the Addiction Research Foundation in Ontario, Canada, says that the international mobility of people is leading to the Westernization of habits.

"As you know, tobacco, alcohol and drugs are an integral part of the Western way of life. What is to be deplored is the lack of a tradition of moderation in the use of alcohol. People in developing countries have not yet learned to live peacefully with alcohol, to fear its dangers and the consequences of abuse.

"They are also not cautious of tobacco. I predict that in 10 or 15 years, we shall see a real epidemic of cancer in Third World countries because of their lack of knowledge of the harm tobacco can do. The situation is the same with alcohol. The multinationals think of the Third World as a market with a bright future for these cheap products. The people there, in their struggle with poverty, are an easy target for the manufacturers."

THE CASE OF CHILE

Chile has been producing wine and "chica" since the time of the Spanish conquest and of the Incas respectively, and it now has serious health problems directly related to alcohol. The same is true of Brazil, Argentina, and in fact Latin America as a whole. Chile has one of the highest rates in the world of cirrhosis of the liver. One adult in five is recognized as having an alcohol problem and five percent of the population over 15 are definitely alcoholics.

The government has recognized the seriousness of the problem and is trying to set up programs to alert not only the general population but the medical profession as well. An IDRC-funded project

is aimed specifically at educating medical personnel to improve their diagnosis and knowledge of the health problems related to the abuse of alcohol. Of the alcoholics admitted for treatment to Santiago's hospitals, only 20 percent were noted as such on their admission card. Dr Alfredo Pemjean and Dr Ramon Fluorenzano of the School of Medicine of the National University of Chile are currently busy preparing changes in the training of doctors in Chile so that they can better detect problems arising from alcohol overconsumption and treat them without prejudice.

PUBLIC PRESSURE IN BOTSWANA

Developing countries cannot afford to treat alcoholics in institutions, according to Archibald. Each country has to think of ways to treat such people as outpatients, rather than hospitalize them. That, of course, will require personnel trained to help the one in five adults with a drinking problem.

For the last 20 years about 10 percent of all admissions to Botswana's psychiatric hospital have had to do with alcohol abuse. In the last few years there has been a considerable increase in the admission of male alcoholics. The

general public of this poor Southern African country believes the problem is serious and should be dealt with. With more than half its population under the age of 15, Botswana has every reason to mobilize its resources to counter this serious situation.

Reacting to this popular pressure and the concern of the medical profession, the Government of Botswana has decided to attack the alcohol problem. An IDRC-supported research team from the University of Botswana, for example, is trying to understand public attitudes toward alcohol, particularly those of youth, to determine what factors lead to regular and excessive consumption. Before anything can be done there is a need to understand the problem of alcohol abuse better.

"In Nigeria 13 new breweries have been built in 10 years to meet rising demand," says Archibald. "It is an industry that is profitable for governments and even for part of the population. But if the problems caused by alcohol cannot be coped with, such countries will lose greatly not only on the economic and social levels, but at the human one too. From this point of view, Nigeria is an obvious example of a country grappling with serious problems of alcohol and drug abuse. You know, alcohol, drug, and tobacco abuse can quite literally put a stop to development or seriously compromise it.

"Each country must set its research and popular education objectives," says Archibald. "Third World societies are going through a period of profound change. They must strive to better define the epidemiology of certain diseases and to understand their own

ALCOHOL IN THE MEDIA

If, as Archibald says, the increase in alcohol consumption is a result of the Westernization of life-styles in the Third World, particular attention should be paid to Western cultural products that portray stereotypes extolling the use of alcohol. The US National Research Council's *Newsreports* has published a

The industrialized world has not yet turned the corner.

study dealing with the 10 most popular TV dramas. It revealed that at least 10 scenes of alcohol consumption were shown for each hour of broadcast time. In effect, the cultural products of television or the cinema can contribute to the general perception that alcohol consumption is normal and acceptable by linking it to an increasing number of situations and contexts.

In Peru, where many American TV programs are among the most popular, the Centre for the Study and Promotion of Development, with IDRC support, has studied the content of the most widely watched TV programs. It hopes to identify the needs and tastes of viewers in

order to design educational programs that better reflect the values of the marginal population. They also want to take into account the ethnic, cultural and geographical differences and peculiarities.

There may in fact be a link between this appropriation of the media by the people of the Third World and the trend to decrease the Westernization of habits that for several decades has been leading to new and serious health problems related to alcohol and drugs.

In the West, cigarettes and other forms of tobacco have been linked to numerous diseases. In the case of alcohol, a lot still needs to be done. In the study by Professor Lawrence Wallack of California, quoted in *Newsreport*, it is pointed out that during the broadcast of TV dramas the rate of alcohol consumption is higher than normal, and that references to alcohol consumption are, generally, very positive. This means that the West has not yet dealt with the contradictions inherent in its way of life. How then, can one hope to see the Third World get rid of the image of cigarettes and drink as being upper class and a sign of success and happiness?

The industrialized world has not yet turned the corner. In the developing nations, the repercussions of an idealized and misleading way of life are only just beginning to be felt. □

"The developing countries cannot afford to treat alcoholics in institutions. Each country has to think of ways to treat such people as outpatients rather than hospitalize them."

society. It is up to each country to come up with a policy to deal with alcohol and drugs, and to decide, on the basis of thorough knowledge of the social factors involved, how to take advantage of the changes going on.

"It cannot be denied that the production of alcohol contributes significantly to the economies of many countries or that its consumption can be a very agreeable habit — if of course people have learned to manage the negative effects and if there is protection against the ruinous results of blind excess."



Photo: Denis Marchand

A variety of alcoholic products in Malaysia



Photo: Gerald Toomey, IDRC

Easy access: Youngsters sell beer on the outskirts of Gaborone, the capital Botswana.

COOPERATIVES IN BURKINA FASO

A SPIRIT OF SELF-DEVELOPMENT

No access to the sea, a difficult climate and poor soil, clearly inadequate sources of energy, a subsoil lacking in raw materials, emigration of youth to the Ivory Coast, a weak internal market... These are some of the problems of Burkina Faso (the new name of Upper Volta since the military coup of August 1983). The country is among the poorest on earth. All the same, many of its people think it can leave underdevelopment behind by using co-operatives as an instrument of progress.

Burkina Faso has co-operatives in the areas of market gardening, rice production, artisanal orchards, livestock raising, crafts, savings, and credit. Although the market gardening and livestock co-operatives have a turnover of several hundred million CFA Francs (CA\$1 = 350 FCFA) and the savings and credit co-operatives have built up savings of 300 million FCFA (\$850 000), they have not yet revolutionized the economic life of Burkina.

A MARGINAL SECTOR

In this country with six million people and a Gross National Product of \$1 billion, co-operatives remain a marginal sector among the various economic forces. But their impact should not be judged solely in economic terms. When they were asked to assess the success of the co-operatives, social scientists Blaise and Robert Ouedraogo both said that such organizations had contributed to a change in mentality. "Before the co-ops started," they said, "the peasants would say 'come and do something for us'. Nowadays they ask us to come and help them to do something." The success of the co-operatives has been in arousing a spirit of self-development, a spirit of autonomy which often takes the form of criticism of government representatives.

Both sociologists are active 'field' researchers. They and about 10 others are conducting 'action-research' in a training program run by the International University Cooperative (IUC) and funded by IDRC. IUC is an international network of university people and universities set up in 1977. It works as a kind of 'long distance university', teaching not by radio or correspondence but through professors who visit Burkina regularly.

SUPPORT FROM LOCAL SAVINGS

It is the savings co-operatives that have made the most progress in the last 12 years. They have about 18 000 members spread among 40 co-operatives and 86 branches.

Although the average per capita annual income in Burkina is only around 87 500 FCFA (\$250), average savings are close to 16 000 FCFA (\$45). The country thus has considerable potential for savings. The problem is that the savings and loan co-operatives in Burkina do not share a common philosophy or function in the same way. In addition to the savings banks concentrated in the

Southwest, there are in the Northwest those of the Union of Savings and Loan Associations of Upper Volta (UAVEC), and in the North Central area of the country one finds the savings banks of the Association for the Development of the Kaya Region (ADRK). With three different kinds of co-operatives and savings philosophies, it is little wonder that there is still not a national union of savings and loan co-operatives.

Worse still, all the co-operatives find it difficult to get back the money they have lent. The economic health of the savings banks, which are recognized as the strongest, could have been seriously endangered had there not been a change of direction last March. Before the beginning of 'Operation Payback' the total in non-performing or overdue loans was 77 million FCFA (\$256 000), about 30 percent of all savings. By the use of extreme methods — calling in the police and suing — the situation was successfully reversed.

This state of affairs reveals social and cultural limitations. The members of the credit committees and the supervisors of the banks are often friends or relatives of the borrowers and often cannot refuse them a loan.

TRAINING NEEDS

Whether in the savings banks or in other kinds of co-operatives, everywhere one runs into the problem of training. Speaking of these difficulties, Blaise and Robert Ouedraogo refer to "the organization, the adaptation, the training of people". These are not the only limitations. The lack of material and financial resources, the climate (insufficient rainfall in particular), and an inadequate system of highways all severely tax any efforts at development.

But the basic need and necessary condition for development is training. Without it there can be no economic progress. It is often, however, "the most difficult condition to meet," says Gilles Morin, chief adviser to the Société de développement international Desjardins (SDID) in Burkina. The importance of training is exemplified by the policies of the savings banks of Bougouriba. Although they have attained a measure of financial and administrative autonomy, they continue to place major emphasis on training.

What about the future of the cooperative movement in Burkina? "The outlook is most promising," says Morin. "Philosophically co-ops are consistent with the government's intention to give priority to organizations set up by villagers. Economically, they can take over from the State, which simply doesn't have the resources to look after everything." □

François Huot is a Quebec freelance journalist. He recently visited Burkina Faso to study the development of co-operatives as part of a project of the Fédération professionnelle des journalistes du Québec, supported by the Canadian International Development Agency (CIDA).



Burkina Faso's "Caisses populaires": Rapid growth of a cooperative industry.

Photo: François Huot

LESSONS FROM INDIA

SUCCESS THE COOPERATIVE WAY

By DAVID CREIGHTON

Each morning before the sun burns the mist off the irrigated rice paddies, Suteera Desai, like a million other small farmers in India, swishes creamy milk from her buffalo cow into a stainless steel milk pail. She strains it carefully into the carrying pail, puts aside enough for her family's breakfast, and dispatches her son on his bicycle to the village cooperative collection station.

There he watches as the milk is tested for butterfat content, weighed and marked in the pay book. He then returns home where his mother has already fed the buffalo its ration of rice straw, sugarcane tops, and grass cut from the irrigation ditch and roadside. In the evening, Mrs Desai herself makes another delivery of milk and receives a cash payment for the previous day's deliveries.

The cooperative provides a guaranteed market for her milk at a fixed price and supplies feed at a reasonable cost. It also makes regular and effective veterinary and extension services available in the village more cheaply and efficiently than any private or government service could.

Mrs Desai's co-op, and 36 600 other milk cooperatives like it in a country of 750 million people, sprang up of necessity after 1945 when capricious and usurious entrepreneurs in an uncertain environment made the economic life of small farmers untenable. Officially the first milk co-op, the Kaira District Cooperative Milk Producers' Union (AMUL) today has 350 000 members and centres on the village of Anand in Gujarat

State. It was chosen to be the government's showcase for successful cooperative development and became the pattern for the government's "Operation Flood", the largest dairy development program in the world, which began in 1970.

Similarly, in Maharashtra State where irrigation projects had made sugarcane growing a lucrative industry, small farmers found themselves being victimized by private factory owners. But by 1951 they managed to establish the first cooperative sugar factory, at Pravaranagar, the beginning of a trend which, 30 years later, dominates the industry in India.

After the Second World War, the Government of India, like those in many developing countries, systematically began to encourage the growth of cooperatives both as instruments of rural economic development and as seedbeds for social democracy. Today the cooperative societies number nearly 300 000 with total membership exceeding 120 million people. In 1983-84, they disbursed 29 billion Rupees (nearly CA\$3.5 billion) in agricultural credit — 60 percent of the institutional credit in the country — and marketed over 25 billion Rupees (\$3 billion) worth of agricultural produce, including milk, sugar, tea, fish, cereals, fertilizers, spices, and fibres. A total of 3.2 million tonnes or 54 percent of all the sugar in the world's largest sugar-producing nation was processed in cooperatively owned factories. The nation's dairy cooperatives had sales of 38.28 million Rupees (\$4.67 million) in 1983 and, under Oper-

ation Flood, their numbers have increased by about 5000 every year. The Indian cooperative movement is now the largest in the world.

CRITERIA OF SUCCESS

Despite the apparent success, many cooperatives are running at a deficit, depend on outside support longer than expected, or are accused of being undemocratic, of having a negative impact on the poorest of the poor, or otherwise of being "unsuccessful". With Indian cooperatives taking so many forms and operating in such varied environments, "success" can only be measured against the cooperatives' own criteria, although these generally include at least economic viability and the provision of certain social benefits to co-op members and communities. The myriad factors determining success and failure of cooperatives, although often debated piecemeal, have never been systematically examined in India — until now.

A team of researchers from the University of Delhi and McGill University in Montreal, Canada, with the assistance of members of the Indian co-op movement and government officials, are now finalizing the methodology to be used in a number of detailed case studies of cooperatives. When completed in two years' time, this IDRC-supported project will be able to shed light on the elusive question of what factors make for "success".

The scholars involved come well prepared. Project leader Dr Baparao K. Baviskar of the sociology department, School of Economics, University of



Photo: Cooperative Union of Canada

In Tumarikop, India, the Gramodhara Dairy Co-operative provides storage, processing, and marketing facilities to families with one or two cows.

"The Indian cooperative movement is now the largest in the world."

rate, social mobility is minimal, and cooperatives have not thrived as well as those in the dryer, more sparsely populated coastal areas where the social structure is less stratified and more flexible. This relates to the widely held belief in the co-op movement that successful co-ops tend to "level" previously stratified societies.

Another hypothesis is that, while some local government support is required, political interference can destroy budding cooperatives. A sad example is the Saongaon Tea Workers' Cooperative set up in 1974 when the ailing Sonali Tea Estate, seriously in arrears in wages, turned over its estate to the workers. With sustained efforts and after suffering serious hardships, the workers managed to restore the

plantation's productivity and even began introducing social reforms. It was the first tea plantation in India to pay equal wages to men and women. The co-op broke down the traditional labour management dichotomy and effectively used persuasion rather than coercion to discipline problem workers. The co-operative's assets grew as did its profits.

Seeing these successes, the former owners

decided to stage a come-back in 1979 and enlisted the help of the local government, particularly the police. "Ironically," Dr. Baviskar reports, "the leftist coalition State government sided with the former owners, largely because the union which backed the workers belonged to a rival leftist party. The cooperative was eventually destroyed."

An apparent contradiction to this thesis is exemplified by the case of Samakya, a rather complicated multi-service cooperative movement in Hyderabad. The State government has tried various legal manoeuvres to take control of Samakya because it is "unofficial" and more successful than the State co-ops. But this opposition has tended to strengthen and solidify the determination of the membership.

"However," points out Dr. Baviskar, "Samakya is well established. It is far

easier to nip a co-op in the bud than to pull it up by the roots."

The third hypothesis is that the degree of cooperation required is a determinant of success. For example, the small-producer dairy cooperatives require minimal cooperation and have shown considerable success. Mrs Suteera Desai and the other farmers continue to manage their animals and produce milk in the traditional manner while the co-op provides credit, technical services, and delivery to the urban market.

COOPERATION BETWEEN LARGE AND SMALL

A final hypothesis is that some technologies encourage the larger-scale farmers to cooperate with small farmers for their mutual advantage. Nearly all co-ops are dominated by wealthy farmers but where economies of scale in production plants are realized only at maximum utilization, as in the sugar factories or dairy plants, it is in the large producer's interest to encourage the participation of the smaller producer members. The plants that are owned by the co-ops have generally been very successful. But where the sugar factories are privately owned, the large growers have tended to monopolize the factory for their own cane at the time of maximum sugar yields, thus exacerbating the gap between rich and poor.

Many other variables, of course, are constantly at work in the life of a cooperative. The four hypotheses and others will be assessed and refined by the researchers. In order that comparative analyses can be made later, each of the proposed 18 case studies will be reviewed to see how they relate to the hypotheses. The researchers will also be asking: who do the cooperatives really benefit? Are the poor farmers and landless poor included or are the wealthy the real winners?

The project participants expect to see important contributions made to the sociology of development, to the training of young academics, to the enhancement of collaboration between research institutions, and, perhaps, to some illumination among cooperative and government policymakers. Their deliberations may not touch the relatively secure lifestyle of Mrs Desai in her dairy co-op. The real and perennial question, after all, is how will her experiences touch the policymakers? □

David Creighton is an Ottawa-based writer and researcher.



Agricultural co-ops can provide subsidized seed, fertilizer, and small implements to member farmers. Here an oilseed farmer receives a backpack sprayer.

Delhi, has studied various aspects of the movement over 22 years. And his former student, Dr Don Attwood of McGill's anthropology department, has devoted much of his academic career to the area. The graduate students on their teams are "exceptionally motivated" — they obtained over \$55 000 in additional fellowships on their own initiative, and have spent their summer holidays in intensive language training and other preparations.

In 1983 professors Baviskar and Attwood collaborated in organizing an IDRC-supported seminar entitled "Co-operatives and Rural Development" in conjunction with the XIth International Congress of Anthropological and Ethnological Sciences. The 24 papers presented there are now being prepared for publication by Oxford University Press.

WORKING HYPOTHESES

The discussions they held led to the formulation of four working hypotheses about the constraints to the success of new cooperatives. The first is that where the existing social structure is highly stratified and rigid, shared interests, joint responsibilities and mutual decision making will be inhibited. In the humid and densely populated coastal areas, the caste system is most elabo-

"It is far easier to nip a co-op in the bud than to pull it up by the roots."

CHINA'S HUMAN RESERVOIRS

THE PROMOTION OF SMALL TOWNS

by LI XIN

In many areas of the world rural populations are expanding. But the amount of land remains the same and, where farming is becoming mechanized, fewer agricultural jobs may be available. So what do the extra labourers do? In most countries they move to the makeshift shantytowns of overcrowded cities.

In China, only about 200 million of the 300 million rural labourers are needed to farm the country's 33 million hectares. Even with a policy of one child per couple, it is predicted that the number of peasant labourers will have increased to 400 million by the turn of the century.

As an alternative to migration to the already overcrowded cities, China is promoting the growth of rural towns, including the seats of county, district and township authorities, as well as larger marketplaces and communities serving industrial, mining and tourist centres. A leading sociologist, Professor Fei Xiaotong, describes small rural towns as "reservoirs" into which the surplus rural labour might — and should — be diverted. After extensive investigations over the years, he now predicts that by the year 2000 the total population of small towns throughout China will have grown to at least 300 million people — 140 million able-bodied rural labourers and their families.

In Wenzhou city, in Zhejiang province, East China, 383 000 people are jammed into an area of 11.3 square km, for an average of 33 894 people per square km. (Hong Kong's density is 28 500 per square km.) In the nine surrounding counties under its jurisdiction, there is an average of 32 people per hectare of farmland, and farming requires no more than 30 percent of the rural labour force of 1.9 million.

Rather than cram into Wenzhou or other overcrowded cities, peasants started collective and family-run factories and shops to provide jobs for themselves. In Liushi town, for example, peasants are operating — collectively or on a household basis — more than 1000 factories producing hardware and simple electrical gadgets. These, plus restaurants, hotels, banks, post offices and other service industries now mushrooming, provide permanent jobs for 10 000 people and temporary work for thousands more.

More than 500 000 of Wenzhou district's rural labourers are now working in col-



Photo: China Features

The factories and shops of this small rural town in East China provide jobs for 7000 surplus rural laborers.

lective and family factories. More than 100 000 are working as sales and purchasing agents, 50 000 are in private commerce, and another 175 000 are undertaking contract work in other parts of China.

TAX BREAKS, LOANS, TECHNICAL ASSISTANCE

Under the policy, peasants are allowed to start private factories and shops in towns near their villages, provided that they are willing to continue growing their own food grain instead of depending on government supplies as city residents do. Rural factories, including those in small towns, are exempt from tax for the first three years of operation. They may also qualify for government loans and technical assistance, and those producing on government orders may have their production incorporated into overall state planning. Supplies

of raw and processed materials for these factories are guaranteed.

In applying for permission to start up factories or shops, peasant families are obliged to contribute towards the construction of the town concerned. In southern Jiangsu, for example, rural collective industries provide the bulk of the small town construction funds.

"We live in multi-storey buildings with running water and other conveniences — just like city people," one peasant worker in Bixi town, Changshu, said. "Whatever city people have — parks, cinemas, theatres, cultural centres and department stores — we have, too."

"But we have fresh air, which city people do not have. So why should we take the trouble of moving to cities?" □

Li Xin is a writer with China Features.

BRIEFS

Knowing about AIDS

Major campaigns are needed to inform African physicians and the public about a subject that is still taboo in certain Central African countries — Acquired Immuno-deficiency Syndrome (AIDS).

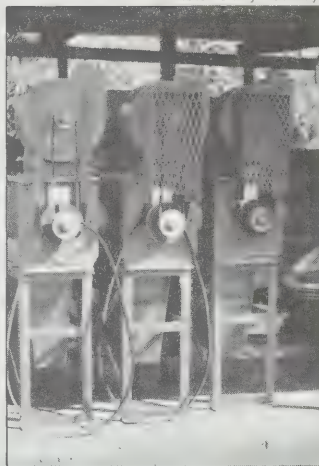
This recommendation, formulated by a group representing Burundi, Cameroon, Central African Republic, the Congo, Gabon, Rwanda, Tanzania, Uganda, and Zaire, emanated from a WHO-sponsored meeting held last October in Bangui, Central African Republic.

So far, South Africa is the only sub-Saharan country to have reported its AIDS

cases (23 in all) to WHO. Studies have shown, however, that the virus is present among large numbers of certain groups: 80 percent of prostitutes in Rwanda; 66 percent of prostitutes in one of Kenya's larger cities; 6.5 percent of a sample of 200 blood donors in the Congo; 6 percent of the population of Zaire.

"It serves no purpose to hide the reality of this disease which has become a major preoccupation among health authorities," said Dr Fakhry Assaad, director of WHO's Division of Communicable Diseases.

Photo: Gerry Toomey



Sorghum dehuller technology is being transferred to private sector manufacturers in Botswana.

Dehullers for export

A small-scale grain dehuller developed in Botswana by the Rural Industries Innovation Centre with IDRC support is meeting with commercial success both in that country and in its neighbour to the South.

"Interest from South Africa has been growing over the past two years," says RIIC manager Kit Morei.

To date, 36 dehullers have been installed in 21 villages in Botswana. Based on a machine designed by Canada's Prairie Research Laboratory in the mid-1970s, the RIIC dehuller is used in conjunction with a hammer mill to produce sorghum flour. It can handle small batches of grain brought in by individual villagers (service milling), as well as larger quantities to be processed on a continuous-flow basis (commercial milling).

In terms of taste, sorghum is the grain of preference in Botswana. It also has the advantage of being drought-resistant. The dehuller is now helping to re-establish demand for sorghum because it eliminates the long hours of pounding work that women, using a mortar and pestle, have traditionally had to put up with to prepare the grain for cooking.

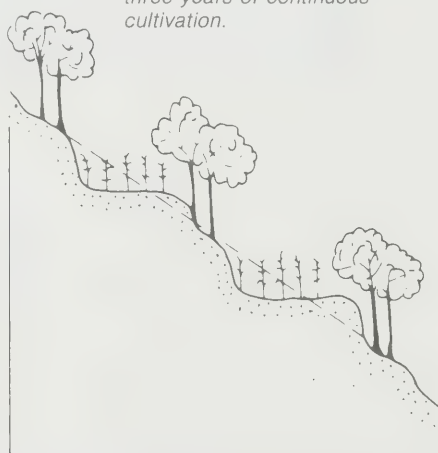
The dehuller is being tested in other African countries including Tanzania and Zimbabwe. What is also encouraging is that RIIC has so far sold about 30 dehullers in South Africa and recently took an order for another 24. This last batch is being manufactured by two companies in Botswana under the direction of RIIC.

HILLSIDE LEUCAENA

Before: Arrangement of corn with leucaena in double hedgerows across the slope.



After: Formation of natural terraces across the slope after three years of continuous cultivation.



In the Philippines, 9 million of the country's 13 million hectares of arable land has been damaged by erosion. But on the most vulnerable terrain, that which is sloped, farmers have begun using a farming system that results in the formation of natural terraces to protect the soil. Seeds of the leguminous leucaena tree (which is able to enrich the soil with nitrogen) are planted in double rows along the contours of the hill. Once the leucaena is fully grown it is cut back about every two months. The cuttings are chopped into small pieces and returned to the soil to decompose. The land between the rows is cultivated and corn is planted. After a few years of working the earth and growing corn in this way, natural terraces begin to form. In effect, the natural tendency of soil to erode down the hill is harnessed to create an ecologically stable farm system.

(Source: "Soil erosion and ecological stability", a paper by Enrique P. Pacardo, in *Soil Erosion and Management*, p. 82, published by the Australian Centre for International Agricultural Research, 1985, Canberra.)

NEW RELEASES

Recommended Methods for Development-Information Systems, Volume 2: Guidelines for the building of authority files in development-information systems. *Anne Di Lauro and Maureen Sly. Published October 1985, IDRC-TS52e, 196 pages.*

This publication contains guidelines for the creation and maintenance of institution authority files and for an authority file of country and region names to be used in the production of printed indexes. The guidelines are intended to be used in all types of information systems — manual or computerized, stand-alone or cooperative, unilingual or multilingual. They include a description of authority files in general, their function in manual and computerized information systems, and their maintenance in a cooperative information system. The Institution Authority File (IAF) recommended for development-information systems is introduced with a description of its guiding principle, structure, and rules.



Laboratory and Field Testing of Handpumps.

Goh Sing Yau. Published October 1985, IDRC-TS 51e, 138 pages.

An easily maintained handpump incorporating low-cost plastics (polyethylene and polyvinyl chloride) in the manufacture of the below-ground components has been developed for use in rural areas of the developing world. To ensure that it would function adequately under actual field conditions, laboratory and field testing protocols were developed

by researchers at the University of Malaya, in collaboration with the Ministry of Health, Kuala Lumpur, Malaysia. This technical study contains a detailed description of these protocols. It includes a mathematical analysis of the reciprocating pump and a methodology for optimizing the design of the valve assemblies through computer simulation and selected laboratory testing. The methodology for field testing is described and standardized field survey forms are included. Two computer programs are also included for use on Apple II-compatible microcomputers. These permit the automatic acquisition and processing of data from an experimental rig.



In addition to IDRC *Reports*, the Centre publishes a wide range of material on development issues. These include scientific monographs, reports, and bibliographies on specific IDRC research areas, as well as general interest literature. These publications represent research interests and activities supported by IDRC in agriculture, food and nutrition, population, health, education, information, and social sciences. Films describing the Centre and some of the areas of development research are also available. A catalogue of current material, publications or films, is available from the nearest IDRC regional office or from IDRC in Ottawa (see page 3 for complete addresses).

Publications may be ordered from the IDRC sales agents listed here.

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CIVICIA

Informatics in the Third World

China's wonder tree

Water: scarce and threatened resource

LETTERS

Down to earth

I just read the first copy of *Reports* (October 1985) I have ever seen and was impressed. What I like best about it is its intellectual stimulation along with the fact that it contains such down-to-earth information. I know *Reports* will be of great help to me in my rural social work classes, as well as in my doctoral studies coming up shortly.

Ken Collier, MSW
Associate Professor
University of Regina
Saskatoon, Saskatchewan
Canada

Valuable information

IDRC *Reports* is one of the few publications I read regularly in the course of my research. I would like to say thank you for several years' worth of interesting and valuable information.

Peter Adamson
Oxford, England

Peter Adamson researches and writes UNICEF's annual publication entitled *The State of the World's Children*. See p. 25.

The Editors

Research for the needy

After reading three issues (Volume 14) of your quarterly magazine *Reports*, I feel obliged to make a few remarks. First, on behalf of the Institute of Education, Tanzania, I would like to thank you for including us in the list of your readers. We have found the magazine quite useful and readable.

Secondly, your October 1985 issue has provided vital information to me and my colleagues. I was fascinated with the letters page where your readers expressed their views which enabled me to get some ideas about your past issues.

Thirdly, I read your 15th anniversary supplement with keen interest. I liked IDRC's insistence that research results be utilized for the benefit of those most in need and also the spirit of helping developing countries to help themselves.

B.R. Seka
National Institute
of Education
Head, Research and
Evaluation Department
Dar es Salaam
Tanzania

Essential nutrients for crops

I would like to comment on the first two articles in the January 1986 issue of *Reports* (Vol. 15, No. 1), "Gardeners of the Desert" and "Mycorrhiza".

The application of zinc and manganese besides nitrogen, phosphorus, and potassium, following Liebig's "Law of the Minimum", is very interesting. The crop consultants of Taran Corporation perform this exercise on North American farms. Our program assures that all essential nutrients are provided to programmed crops, for specific yield targets. It is surprising to us how little attention is given to the fact that nitrogen is limited by the level of all other essential nutrients.

As far as work with mycorrhizae is concerned, soil fertility is not a bottomless pit. Mycorrhizae and fertility will combine to provide better crops. In fact, we suspect that crops grown using Taran's techniques likely have more and more vigorous populations of mycorrhizae as the sugar production of growing crops is more efficient. I agree that the potential for helping Third World countries with limited funds is great. However, we would caution against replacing fertility completely with mycorrhizal enhancement.

Allan Spicer
Taran Corporation
Pt. Burwell, Ontario
Canada

Farsi computer terminal

Thank you very much for sending us copies of *Reports*. I looked through an article titled "The Electronic Net" in your July 1985 issue. In this article, the author mentions nations that use non-Latin alphabets and have managed to use them on computer peripherals and data communications equipment. In spite of widespread use of the Farsi alphabet (almost the same as Arabic)

in data processing in my country, it is missing in the article's list. It is also worth mentioning that only three years after the Great Islamic Revolution people at ITRC (Iran Telecommunication Research Centre) successfully designed and implemented a very good-quality bilingual (Farsi-Latin) computer terminal.

Ghasem Jaberipur
Vice Chancellor
Shaheed Beheshti
University
Islamic Republic of Iran

Banteng, the tropical "cattle"

In reference to the article entitled "The Un-Cattle of Bali" by Anne Fisher in the October 1985 issue of *Reports*, I would appreciate knowing whether the Banteng or "Bali cattle" can adapt to the Canadian climate and whether they have ever been or can be imported into Canada. I look forward to a reply.

Keith C. Hobbs
KEICLIF Farms
Ottawa, Canada

C. Devendra, a Singapore-based program officer in IDRC's Crops and Animal Production Systems program, says he is not sure whether they could adapt to the Canadian climate but that they have so far been introduced into Malaysia and Northern Australia only (i.e. tropical regions). Tropical cattle, he says, are rarely introduced into temperate regions.

The Editors

Letters from readers are welcomed and should be addressed to:

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The IDRC Reports
P.O. Box 8500
Ottawa, CANADA K1G 3H9

Reports

THE IDRC

The IDRC Reports and its companion editions in French and Spanish — *Le CRDI Explore* and *El CIID Informa* — are published quarterly by the International Development Research Centre. Their aim is to keep readers informed of the activities of IDRC and to present articles on subjects related to the Centre's fields of interest. An Arabic version *جولت للتقنية* is published annually. Copies are available on request from the Communications Division, IDRC, P.O. Box 8500, Ottawa, Canada K1G 3H9. *Editor-in-chief:* Jean-Marc Fleury, *Associate Editors:* Gerry Toomey (English edition), Jacques Dupont (French edition), *Spanish edition:* Stella de Feyerbaum

CONTENTS

Letters		2	Water from the sun	Gerald Toomey takes a look at a solar-powered water distillation scheme in the drought-stricken Kalahari.	16
Navigating the micro-electronic labyrinth	The Third World needs to find out what impact the microelectronics revolution is having on it. By Jacques Dupont.	4	Rugged reservoirs	New construction techniques in Thailand make for sturdier water reservoirs. By Denis Marchand.	18
Bit by bit	Robert Valantin and David Balson report on several applications of computer communications in the developing countries.	5	Dwindling water in the sinking cities	Several giant Third World cities are depleting their underground water and are sinking as a result. Danilo Anton explains.	19
Software: Made in India	India is keyboarding its way into the lucrative world software market. By Jaya Raj.	7	Agua Del Pueblo	In Guatemala, a rural water and sanitation agency has helped a village to tap a mountain stream. By Steven Hunt.	21
Macro-solutions on microcomputers	The workhorse of the computer age is helping developing countries to plan crops, manage debts, and use census data. By Jean-Marc Fleury.	9	Kano's cowpea revolution	In Northern Nigeria a massive agriculture project promotes the cultivation of high-yield cowpeas. By Gun Lundborg.	22
Paulownia: China's wonder tree	Millions of these trees are being planted to improve crop yields and protect the environment. Chin Saik Yoon and Gerald Toomey report.	11	Commentary	TV can be a powerful development tool, but so far it has a poor track record in Africa. By journalist and media watcher Iain McLellan.	23
Just add potatoes	In Peru, reports Robert Charbonneau, dehydrated potatoes are mixed with cereals and dried vegetables to make a nutritious food supplement. And cooks love it.	13	Briefs	News and trends in development.	25
Women and water	Groups of Third World women have taken charge of the construction and maintenance of handpumps. A photo feature by photographer/filmmaker Neill McKee.	14	New releases	New publications from IDRC.	27

The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in five sectors: agriculture, food, and nutrition sciences; health sciences; information sciences; social sciences; and communications. IDRC is financed solely by the Parliament of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are located at 60 Queen Street, Ottawa, Canada (P.O. Box 8500, Ottawa, Canada K1G 3H9). Regional offices are located in East Africa (P.O. Box 62084, Nairobi, Kenya); West Africa (B.P. 11007, C.D. Annexe, Dakar, Sénégal); Asia (Tanglin P.O. Box 101, Singapore 9124, Republic of Singapore); South Asia (11 Jorbagh, New Delhi 110003, India); Latin America (Apartado Aéreo 53016, Bogotá D.E., Colombia); and the Middle East (P.O. Box 14 Orman, Giza, Cairo, Egypt).

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Front cover: Electronic components are assembled in a Japanese plant in Malaysia. This issue of Reports looks at the position occupied by Third World countries in the "informatics" revolution. See articles, pages 4-10.

NAVIGATING THE MICROELECTRONIC LABYRINTH

By JACQUES DUPONT

Data processing and microelectronics are sending unprecedented shock waves through modern society. To date, only the Western industrialized countries have conducted studies on the impact of new information technologies. In the Third World, the effects of such changes could turn out to be more negative than those feared by the industrialized countries.

Will a handful of technologically advanced countries restrict the role of all others to that of passive consumers of finished products? Is there too great a gap between the frontrunners and the developing world?

Mexico, India, Brazil, South Korea, and other nations strongly desire to profit from this veritable social revolution which has jolted the whole world. Economically speaking, the value of production of electronic goods is now greater than that of some of the more traditional industries such as oil, coal, steel, automobiles, and chemicals.

The application of microcomputers to all aspects of human organization is one of the distinguishing features of this decade. The developing countries have also adopted computer technology and are trying to devise ways to maximize its advantages. In Chile, for example, the first large computer was introduced in 1971. Now there are more than 1200 systems in operation despite the lack of an adequate educational and research infrastructure.

CHOOSING TECHNOLOGIES THAT FIT

It has often been said that it's absurd to talk of the Third World as if it formed a relatively homogeneous group. Where new technology is concerned the comment is even more justified. In the case of telephone service, for example, the differences in equipment between Africa and Latin America force one to distin-

guish between rich and poor countries, at least technologically speaking. Some countries have a great deal more capital available to them, an educational system that can respond to demands for new specialized training, and an industrial history of being able to take over a new technology for themselves.

NO IMPACT STUDIES

But do Third World governments, large and small, have the right tools to choose intelligently from among the numerous options put forward by the technological challenge of the modern age? "There are almost no impact studies of the new technologies," says Amitav Rath, Associate Director responsible for IDRC's Science and Technology Policy Program. "After all, the phenomenon is relatively new and dispersed, and impacts are difficult to categorize. In some areas — transportation and process control of capital-intensive plants, for example — computerization is essential. In sectors such as banking, countries have a little more choice, but the financial costs of saving jobs in this area are very high.

"Now that economic activity is more competitive and internationalized, can countries still think in terms of the conventional ways of doing things without running the risk of losing their competitiveness? Naturally, the poorest countries are the most vulnerable. They run greater risks of losing jobs than the more industrialized countries and of slipping back in the struggle for export markets."

A number of Third World countries have begun research efforts on the effects of microcomputers and microelectronics. They are among the nations best able, at the moment, to take advantage of new information technologies. Teams in Brazil, Korea, India, Mexico, and Argentina have linked up and will work to achieve a better understanding of this worldwide trend in "informatics".

Comparative studies of their experience should be useful to other developing countries that are beginning to search for national policies.

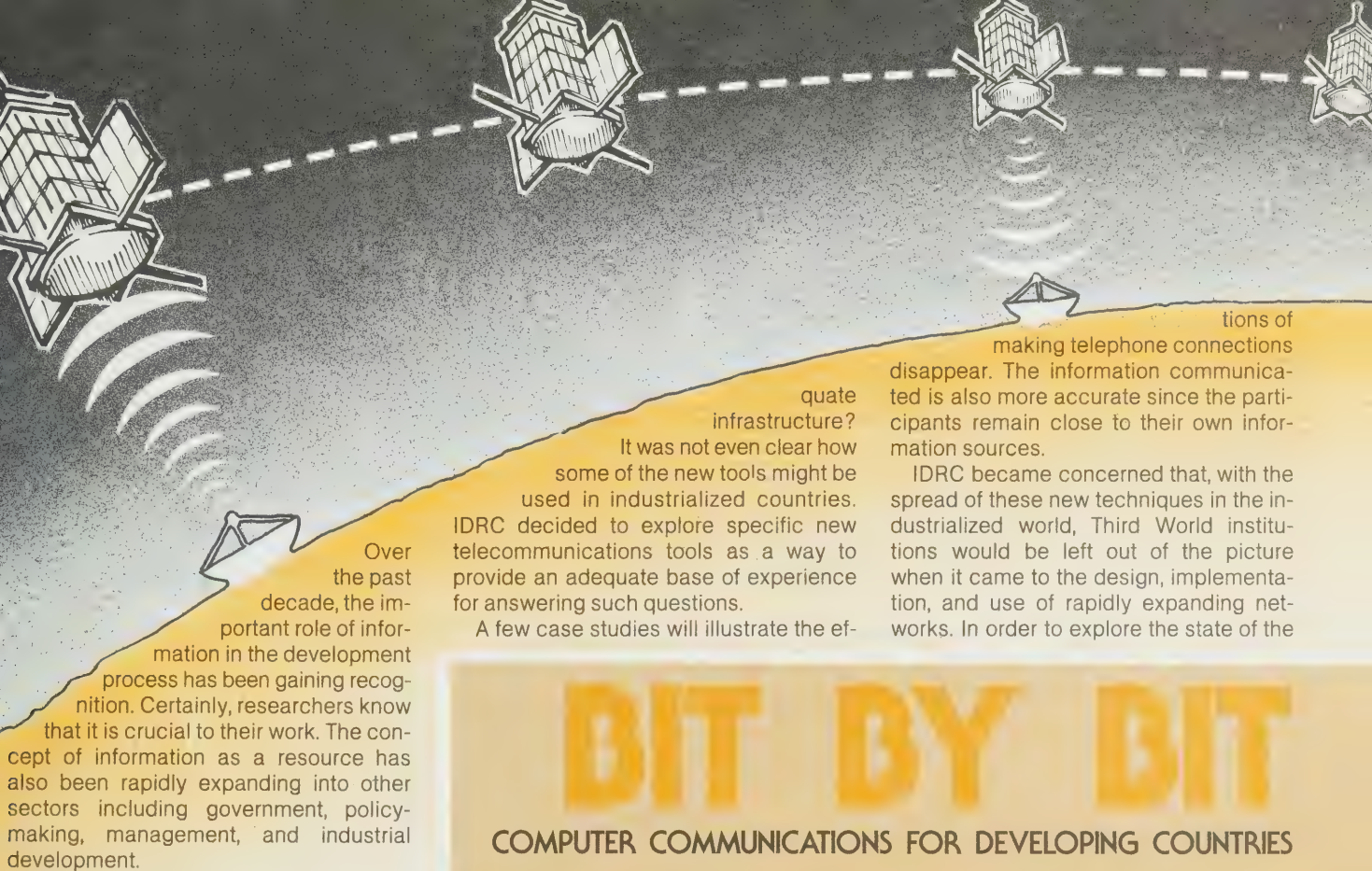
Another IDRC project is attempting to help Africans catch up in research, knowledge, and control of microcomputers, which are more likely than their technological predecessors to be useful, inexpensive tools. The Institute of Computer Science in Nairobi, Kenya, will provide better training for 20 people in data gathering and the management of software that can be used in small research centres.

Lastly, in Chile, the Centro de Estudios Sociales is working on a project to measure the penetration of computers in the country and to describe more thoroughly the socioeconomic environment in which they are operating.

MILITARY TECHNOLOGY

"A disturbing fact," Rath concludes, "is that quite a number of technological changes in the sector are of military origin. In the USA even today most software research is funded for military purposes. This makes access to new developments difficult for many countries."

In their book *L'ordinateur et le Tiers-Monde* (Computers and the Third World) published by François Maspero in France, Mattelart and Schmuckler write: "If there is to be a new balance of industrial development between the North and South, the North will have to give up treating the Third World as a collection of more or less solvent receptacles for products or factories, and draw them into the building of a new world economic order not restricted to expanding the limits of the North's markets." In order to see their way through the complex technological labyrinth, Third World countries will first have to learn how to use the new electronic tools to suit their own needs and aspirations. □



Over the past decade, the important role of information in the development process has been gaining recognition. Certainly, researchers know that it is crucial to their work. The concept of information as a resource has also been rapidly expanding into other sectors including government, policy-making, management, and industrial development.

Developing countries see the advantages and necessity of an adequate information base for their development. In fact, some of these countries are hoping that, in at least some sectors, they can skip the industrialization stage and go directly to information-based industries.

New technologies and the tools they engender have facilitated and popularized all aspects of the information cycle. The tools — software, for example — are a necessary response to the information explosion that has threatened to overwhelm potential information users, at the same time as it has held forth the promise of answering so many questions. In the decades to come, computer and telecommunications services and their associated tools will appear as commonplace as writing "technology" and books do today.

APPROPRIATE OR NOT?

Whenever a specific information tool is introduced in the Third World, a fundamental question must be asked: Is the tool "appropriate" for developing countries? The danger here is that an industrialized country or agency involved in technology transfer may unwittingly prejudge a particular technology or tool as "inappropriate" and reject it. There is thus a need for informed choices, based on research, experimentation, and analysis by the recipient countries themselves.

By the late 1970s it was clear that telecommunications would have an increasingly important role to play in information systems. But was this relevant to developing countries that lacked ade-

quate infrastructure? It was not even clear how some of the new tools might be used in industrialized countries.

IDRC decided to explore specific new telecommunications tools as a way to provide an adequate base of experience for answering such questions.

A few case studies will illustrate the ef-

tions of making telephone connections disappear. The information communicated is also more accurate since the participants remain close to their own information sources.

IDRC became concerned that, with the spread of these new techniques in the industrialized world, Third World institutions would be left out of the picture when it came to the design, implementation, and use of rapidly expanding networks. In order to explore the state of the

BIT BY BIT

COMPUTER COMMUNICATIONS FOR DEVELOPING COUNTRIES

By ROBERT VALANTIN and DAVID BALSON

forts of IDRC's Telecommunications Program to ensure that technologies have a chance to be tested and used before they are either selected or rejected.

COMPUTER-BASED CONFERENCING

One of the most promising telecommunications tools to appear at the beginning of this decade was computer-based messaging. This is similar to telex but much less expensive, and provides additional features such as upper and lower case characters, individualized formats, and message forwarding.

Systems designers have extended the concept into what are now called computer-based conferencing systems. These allow groups of people scattered around the world to discuss, over a period of days, weeks, or months, topics of common interest such as scientific issues.

Each message is transmitted to the host computer and stored in memory. The originator has the choice of addressing one, several, or all participants; the addressees can read any messages at their convenience. The software of certain teleconferencing systems even ensures that authorship of papers is duly recognized or permits participants to vote on issues or reach a consensus.

The asynchronous nature of these systems provides certain advantages over other methods of communication.

For example, problems of communication across time zones and the frustra-

art and seek advice on any potential role for donor agencies, IDRC convened a week-long workshop in October 1981. Entitled "Computer-Based Conferencing Systems for Developing Countries", the workshop brought together experts from Brazil, India, and international organizations involved in informatics. (A report entitled *Computer-based Conferencing Systems for Developing Countries*, IDRC-190e, presents the workshop's conclusions.)

The telecommunications infrastructure and technology needed for computer conferencing are developing in many parts of the world. Even for relatively inaccessible regions, there exist technical solutions to communications problems. Even in 1981, experts at the workshop unanimously agreed that the greatest impediments to international computer conferencing would be legal and regulatory rather than technical. In some instances, national communications authorities do not look kindly on inexpensive digital communications techniques competing with the lucrative traditional communications monopolies they now manage. In others, the authorities simply do not have the cost/revenue information necessary to make decisions on the introduction of international data services.

Computer conferencing systems will be an integral part of the available communications options in the coming years, the workshop concluded. And unless the developing nations can participate in this electronic community of science and technology, they will suffer yet another

er kind of disenfranchisement. This may take the form of a lack of access to the resources of the industrialized nations or even the inability to gain timely access to scientific results and techniques found in the developing countries themselves.

AN INTERNATIONAL EXPERIMENT

The workshop recommended that IDRC support a pilot computer conferencing project involving both developed and developing nations. A suggested topic was the bioconversion of lignocellulosics (the conversion of waste products into energy sources and nutrients), an appropriate area for international cooperative research given the developing countries' pressing need for fuel and food.

Subsequently, IDRC organized an open computer conference, which ran from May to December 1983. Over 100 researchers from many countries participated, with the majority, as expected,

Experts unanimously agreed that the greatest impediments to international computer conferencing systems would be legal and regulatory rather than technical.

based in industrialized countries. Off-line participation modes were provided for those unable to obtain on-line access. The conference ran on two host computers: one in Newark, USA, and one in Stockholm, Sweden. After the conference, evaluations were carried out. The results of these have been published by IDRC (*International Computer-Based Conference on Biotechnology*, IDRC-241e).

The lignocellulosics conference was a useful exercise. As was anticipated, however, the central technical problem proved to be the lack of reliable access to the international data networks by participants in developing countries. Despite the problems, these researchers felt that computer conferencing made sense, especially in light of high travel costs, the scarcity of foreign currency, and the future expansion of the international data transmission web. On the scientific side, they had the benefit of being able to update their knowledge of research activities and to confirm that their own work was on track.

To ensure greater participation of developing country researchers in the future, it will be necessary to improve local telecommunications infrastructures

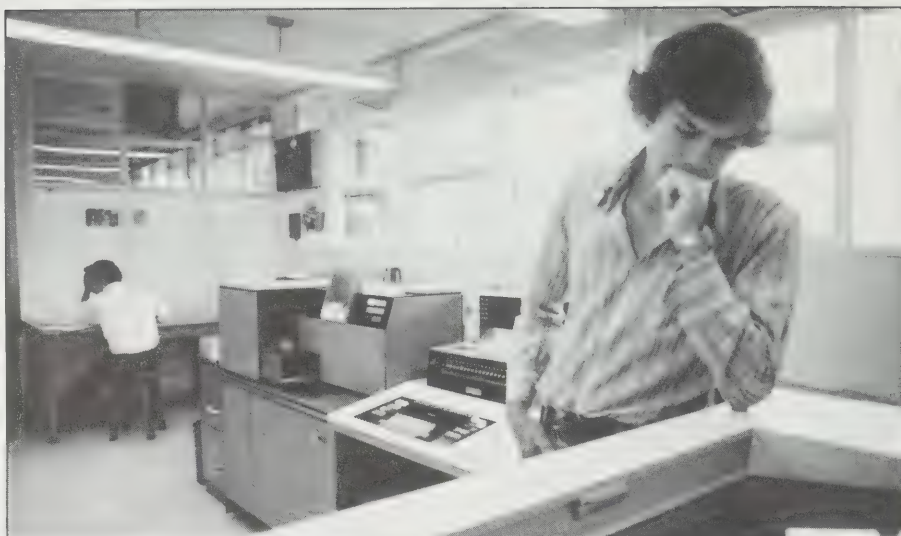


Photo: Ron Poling

Computers at research centres in the Third World, such as this one in Costa Rica, are now exchanging information via international communications networks.

and expand international data transmission networks. Although the computer conference was not a complete success, it did open a window on a new technology for a large group within the biotechnology community.

AGRICULTURAL RESEARCHERS LINKED UP

It is worth mentioning two other IDRC-supported applications of computer-based technologies aimed at improving the flow of technical information between developing countries. The first involves the setting up of a data transfer and messaging network to link the 13 international agricultural research institutions supported by the Consultative Group on International Agricultural Research (CGIAR), an international consortium of research institutions, governments, and donors.

This IDRC-funded project was completed in 1984. It resulted in an operational network, CGNET, linking 8 of the 13 major research sites along with some of the remote sites and many other groups with which the research institutions conduct business. A commercial US-based messaging/conferencing computer acts as the host system for the network.

As CGNET matures, user groups will expand, new applications will be tried (including computer conferencing, bulletin boards, telex-refiling, database access, and data transfer), and new locations will be added to the network.

Another initiative, one in which IDRC's role has been constant but modest, is the development of a worldwide "electronic mailbox" using a low-orbiting communications satellite. The proposed "PACSAT" system is to be based on low-cost packet-radio technology, which should improve the quality and speed of technical information transfer to and from developing countries. The PACSAT

satellite will cover every point on the globe at least twice daily. Messages will be sent and received by ground stations which operate on portable, inexpensive equipment.

As part of the research effort to develop the system, IDRC funded a Canadian nongovernment organization, Inter Pares, to manage a communications experiment using a scaled-down version of PACSAT's "brains" and a satellite built by Britain's University of Surrey. The "field test" took place in January 1985. Despite a number of technical difficulties, the effort paid off: messages were successfully transmitted to and received from the satellite.

The launch of an experimental PACSAT was originally planned for the spring of 1987 during a NASA space shuttle flight, but the tragic destruction of the shuttle Challenger on January 28 has brought that program to a halt. The Radio Amateur Satellite Corporation (AMSAT) is responsible for the technical design, construction, testing, and launch of this satellite. Volunteers in Technical Assistance, Inc. (VITA) is managing the funding and administrative side of the project.

The lignocellulosics computer conference, CGNET, and PACSAT are examples of the application of new information technologies at relatively early stages of development. The evidence provided by these experiments does not conclusively demonstrate either the ultimate utility of these technologies or their appropriateness for developing countries. And although the work was carried out with the needs of these countries in mind, further testing in Third World environments is required. This is clearly the next step. □

Robert Valantin is Associate Director, Information Tools and Methods, in IDRC's Information Sciences Division. David Balson is Program Officer, Telecommunications Systems, in the same division.

Computers were introduced into India in the early 1960s to help in the complex data processing work involved in formulating the country's five-year plans. This opened up a national debate on the ethics of computer use in a populous country with severe unemployment.

The fear that computers might displace workers held up their wider application until 1980 when the government decided in favour of economic and industrial liberalization and gave the green light to computer application in critical areas of production and research. Later the policy was extended to all areas in order to improve productivity and efficiency.

Expectations are now high that computer activity and exports will create more jobs, particularly for the educated unemployed. And even greater potential for absorbing this surplus labour is seen in the development of the software industry.

India's policymakers were conscious of the software potential right from the beginning. Even before the liberalization of computer use in domestic sectors, efforts were made to tap its export potential. Export-oriented software development groups were encouraged in the Exclusive Export Processing Zones (EEPZ). Government incentives helped to push up software export earnings from US\$7.54 million in 1980-81 to \$30 million in 1984-85. The figure for 1985-86, however, is likely to be lower because of a long labour strike in Bombay's Santacruz EEPZ, which now accounts for more than half of the country's software exports. The government plans to expand the software production base beyond the EEPZs to avoid such mishaps in the future.

NEW SOFTWARE CENTRE

The government-created National Centre for Software Development and Computing Techniques (NCSDCT), in Bombay, has provided the R&D and human resources base for Indian software development and exports. This is now being enlarged and upgraded into a National Centre for Software Technology (NCST), to be the focal point for all software activities. Besides providing a policy framework for software development, use, and exports, the new agency will also provide training, disseminate software information, and offer consultancy services in both software and systems development for specialized applications.

Dr N. Seshagiri, Additional Secretary in the Department of Electronics, explained that NCST will further develop the expertise that NCSDCT has already built up in data base management, computer-aided design, computer graphics, computer networks, digital-type design, and text processing of Indian language scripts.

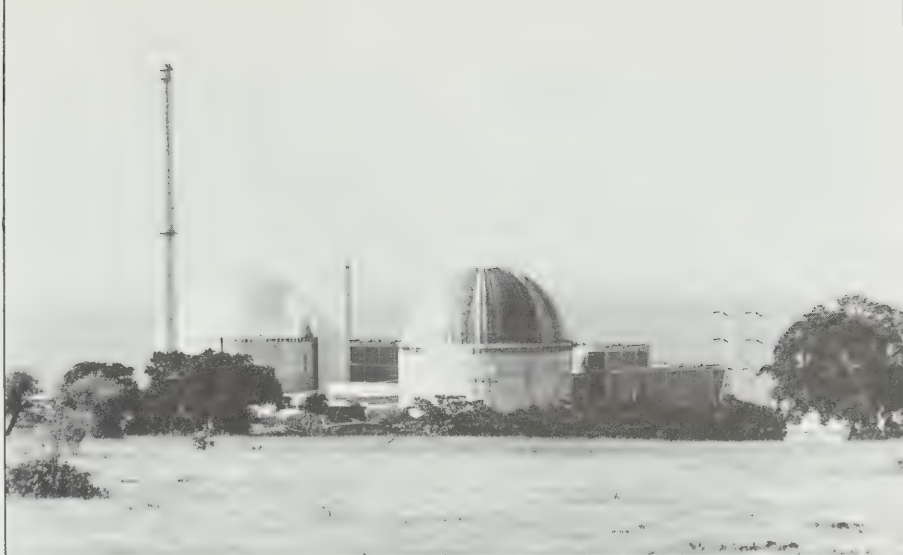


Photo: Atomic Energy of Canada

The Rajasthan atomic power project. Indian software is making its mark on high-tech industries such as nuclear energy and oil exploration.

SOFTWARE MADE IN INDIA

By JAYA RAJ

As the top technocrat in charge of computer development, he believes NCST marks the take-off stage of software activities in India.

At the end of its seventh Five-Year Plan, in 1990, India expects software exports to have reached \$300 million, a 10-fold increase over the 1984-85 level. This would raise India's share in world

software exports from 0.1 percent to 0.6 percent. Experts are unanimous that this target is modest if one takes into account the potential. They say that a share of at least one percent of the world software trade would be easy for India to achieve, provided matching policies and promotional steps are forthcoming.

Of the many recent measures aimed at software development and exports, the concept of Software Export Technology Parks (SETPs) envisaged by the government is a significant one. These parks will be resource centres for software exporting groups.

The government's computer policy announced in November 1984 and the integrated policy statement on electronics made in March 1985 include several steps to promote software exports. One is the granting of industry status to software development groups, thereby enabling them to obtain concessional financing from banking institutions and entitling them to investment allowances. They are also exempt from paying excise duties.

The government has offered to promote software exports through satellite-based data links with overseas computers. Overseas software companies have been offered incentives to set up their production units in India to take advantage of the lower production costs. However, the progress made by new groups entering the software business in the wake of the new computer policy is not that impressive yet. This is said to be due to policy implementation delays at the lower levels of the bureaucracy.

FEW DOMESTIC APPLICATIONS

The Department of Electronics has acknowledged that although the overall achievements in software development in India have been significant, domestic application has not been impressive. This is probably because different sectors are still in the process of computerizing following the government's liberalization policies. However, certain major government-owned sectors — steel and coal production, for example — have just embarked on major computerization

schemes to handle all stages from inventory controls to marketing, using domestic software.

One important area not yet penetrated by computers is agriculture, which accounts for more than 60 percent of GNP. There is much potential for the development of software and computer services to serve the farm sector.

About 500 groups are engaged in software activities in India. The bulk of them (some 400) are software consultancy organizations. The rest are indigenous computer manufacturers with software development schemes, institutions with R&D facilities, or distributors of foreign software.

Indian companies have been developing software for different functions including banking, accounting, and materials management. Some of them have entered sophisticated areas such as computer-aided design and online system software development. And many are in the business of developing system components: assemblers, compilers, utility programs, simulators, screen generators, and so on.

Initially the software export projects executed by Indian companies involved the sending of professional teams to the foreign customer sites for specific assignments. Now there is a discernible shift toward contracted software, written or engineered in India itself.

It was the "unbundling" (separate pricing) of software in the early 1970s that marked the beginning of the Indian software industry. When computers were first introduced into the country, software was not priced separately by the foreign suppliers. Later, when the concept of modular software assumed importance, packaged software services were offered by some Indian firms linked with foreign parties.

ADVANTAGES FOR INDIA

Extensive English educational facilities in India have helped to create a large reservoir of personnel skilled in data processing. A number of other institutions also offer specialized courses in computer disciplines at the university level. Qualified people already working in computer establishments have good job opportunities in various areas of software and hardware application. These factors give India an edge over other developing countries engaged in the software business.

India's lower wages and cost of living make software produced there very competitive compared with software from the industrialized countries. This has helped some Indian software houses to enter the sophisticated markets of North America, Europe, Australia, and Japan. The Computer Maintenance Corporation (CMC), DCM Data Products, and Tata Consultancy Services are among the reputable Indian firms that have made a

mark in software development and exports. Some firms have pointed out to the government that, with certain facilities and incentives, they could become very competitive in the international software market. The government is examining a set of suggestions by the industry.

A spokesman for the government-owned CMC felt, however, that the real opportunities for software groups would

One important area not yet penetrated by computers is agriculture, which accounts for more than 60 percent of GNP.

be in the domestic market. His point was that the growing use of computers in all sectors of domestic activity would generate a huge internal demand that the existing software groups may not be able to cope with.

handle reservations, cargo information, crew scheduling, and aircraft inventory.

- CMC has developed software for computerized news editing and switching of teleprinter transmission at the English-language wire agency, Press Trust of India. It is also working out a national rail reservation system for Indian Railways.

Among the system software achievements of Indian companies are: productivity tools such as program and system generators, skeleton generators, edit generators, and report generators. Software for designing Indian-language type fonts is considered a major achievement. In addition, some of the companies deal in operating systems/cross compilers for BASIC, PASCAL, COBOL, and FORTRAN.

The Indian software industry, however, is about to face the major challenge of meeting domestic demand for computer aids in agriculture, poverty alleviation schemes, and rural development. In sophisticated areas, such as the country's space program, nuclear energy development, and oil exploration, the indigenous software industry has already made a mark. □



Photo: R. Ogile

Indian engineers are designing software to streamline the national railway's reservation system.

The following examples give some idea of recent domestic applications of software developed by Indian companies:

- A package intended to help garment manufacturers was originally developed for the export market, but has been bought by leading manufacturers in Bombay and Delhi.
- A hotel management system for front office, back office, catering, housekeeping, restaurant, and other facilities is being used by leading hotels in the country.
- The domestic airline, Indian Airlines, recently introduced a software system to

Jaya Raj is a correspondent for the United News of India, based in New Delhi.

The scenario has already been written by a number of visionaries. The peasants in developing countries start by using microcomputers to calculate whether it is most profitable to raise cotton, peanuts, or sorghum. Once they become accustomed to the powerful intellectual stimulant offered, it persuades them to re-think their agricultural techniques. Then groups of farmers start to swap their experimental results by satellite. The new networks they set up increase the political power of the peasant masses to the point where they are able to demand a fairer redistribution of resources. Finally, according to the vision of journalist-editor-politician Jean-Jacques Servan-Schreiber in his book *Le Défi Mondial* (The Global Challenge), a Third World united by computers arises as a new force to be reckoned with.

The foundation of this scenario is the microcomputer. What a load, what tremendous responsibilities to put upon a tiny little gadget that appeared only 10 years ago.

TEACHING TOOL

So far, the most widely discussed experiments have been those in schools. In Senegal, for example, the Centre mondial informatique et des ressources humaines (world centre for computerization and human resources), founded and set up by Servan-Schreiber, is conducting a computer education project. Despite the useful progress made by some of the young students, it is difficult to imagine a tidal wave of microcomputer usage in schools in the developing countries. If national ministries of education cannot even afford to replace broken window panes in the schools, how are they going to pay for microcomputers? Besides, the lack of appropriate instructional software is still a serious limitation (see *IDRC Reports*, April 1984).

Although it is true that portable cassette recorders have penetrated even the most remote areas of the poorest countries, it is not only because they are inexpensive, but also because they are so easy to use. All one has to do is press a few buttons. With microcomputers, there has to be software suited to the needs of the users. Even if the machine displays easy-to-follow operating instructions, the user still has to be able to read. The fact is that illiteracy is the companion of poverty — in the world's poorest countries most of the population cannot read or write.

So far it is only those who are already well equipped who can use micro-

computers, which are becoming increasingly common in Third World countries. Still, some of the projects funded by IDRC's Information Sciences Division suggest interesting directions for the advanced use of microcomputers in the developing countries. Even though they are not yet in the hands of the millions of peasants or the urban poor, it is more than likely that they will soon have a really significant impact.

PROGRAM FOR AGROFORESTRY

The microcomputer that comes closest to fulfilling the visions of Servan-Schreiber is perhaps one supplied to extension workers and farmers in Sri Lanka and Kenya by two researchers from the Australian National University, Dan Etherington and Peter Matthews.

and trees, the amount of sunlight each season, the cost of fertilizer and labour, and so on. They are then able to compare the profitability of a variety of crops over several seasons and years. The great utility of this system lies in its capacity to help farmers make the most advantageous choices.

Since the microcomputer obliges farmers to describe their resources and projects, MULBUD is able to reply to a host of questions about how their choice will work out. Among other things, users can see what their income will be if the price of fertilizer doubles, or if disease halves the crop, or if there is a drought, or if the price of bananas drops to keep pace with the increasing size of the harvest.

The program was specially designed to analyze complex agroforestry systems in which plants and trees are closely associated. The computer can aid farmers

MACRO-SOLUTIONS ON MICROCOMPUTERS

By JEAN-MARC FLEURY



A microcomputer with MULBUD software helps farmers select the most suitable cropping patterns. Inset: A senegalese girl learns an educational computer language called LOGO.

A portable microcomputer with a Z80 microprocessor uses "MULBUD" software to analyze the economics of a given crop or of several, such as pineapple, ginger, or corn raised in the shade of coconut palms or banana trees. Farmers enter a precise description of their farms and crops into the microcomputer: the size of plots, the space between plants

in planning their crops both to use their land wisely and to suit the seasons, and in alternating seasonal, annual, or perennial crops with trees. By making it possible to analyze the many options, MULBUD can be of enormous assistance in making agroforestry profitable. Agroforestry is a much more complex form of farming than traditional monoculture, but

it has the outstanding benefit of protecting soil from erosion and depletion. These are the reasons that led the International Council for Research in Agroforestry, in Nairobi, Kenya, to push ahead with this experimental program in East Africa.

MACRO-DEBTS ON MICROCOMPUTERS

Another area as complex as agroforestry is the management of developing countries' foreign debt. It is difficult for those in charge to decide how and where to borrow and how to make the payments. And the sums of money involved are large.

Until recently, only the banks could supply the computer programs needed by customers to plan their borrowing. Not only was this an expensive service, but it goes without saying that the borrowers would have preferred greater independence in their dealings with their creditors.

Now, the Technical Assistance Group (TAG) of the Commonwealth Secretariat, an agency in which most former British colonies are members, is offering special services to indebted developing countries. Its experts were already providing advice on the legal and institutional steps that would help countries to manage the inflow and outflow of loans and payments. Since last year, TAG has had the software available to enable developing countries to manage their debts better using a microcomputer. Thus, for about CAD\$50 000, a developing country can equip itself with its own computer system consisting of a pair of microcomputers, each with 256 kilobytes of

know the exact size of their debt because files are scattered around in several ministries. Even if the only thing it did was to give governments a chance to collect all their loan documents together, the system would already have indirectly achieved something really useful.

The system is set up to record 250 loans or donations (donations represent an inflow of foreign currency) on each 10-megabyte hard disc. If the repayment period is relatively short, less than 25 years, it can record a greater number of loans.

The system, which ensures a certain measure of confidentiality, should be thought of primarily as a management tool — it cannot yet write out the repayment cheques. Its main utility is that it enables financial managers to consider



Photo: Dale Gunthrop, Commonwealth Secretariat.

A Sri Lankan programmer is trained on the CS-DRMS computer system designed to help developing countries manage their external debts.

If national ministries of education cannot even afford to replace broken window panes in the schools, how are they going to pay for microcomputers?

Random Access Memory (a byte represents the capacity to store a single number or letter), and all the necessary peripheral equipment. The software is supplied free of charge. IDRC contributed funds to the development of the software in England and its first installation in Sri Lanka.

It takes four to five weeks to train a user on the system, but what countries find most difficult is to gather up the files on each loan. Sri Lanka's foreign debt, which stands at US\$2 billion, is relatively small, but far too many countries do not

a multiplicity of options. A wide range of borrowing and repayment schemes can be rapidly checked out. If, for example, large numbers of American tourists arrive bearing dollars, should the dollars be retained or immediately applied to paying down debts denominated in dollars or in other foreign currencies? Debt managers can immediately determine the effects upon future disbursements of taking out further loans. "In the end," says Robert Valantin, IDRC's Associate Director, Information Tools and Methods, "borrowers will be able to carry their computers into a bank office and use them to negotiate a loan on the best possible terms."

Grenada has also begun to install the new system. At the same time, possible applications in non-Commonwealth nations, such as in French-speaking Africa, are being explored.

APPLYING CENSUS DATA

The various possibilities of microcomputers continue to stir the imagination.

In Chile, a team from the UN Economic Commission for Latin America has begun to break down the data from recent national censuses so that they can be handled on microcomputers. A large computer is used for the first stage. The plan is to classify the information by regions, cities, or districts. Even if the resulting blocks of information still contain a great deal of data, it is possible to process them on microcomputers equipped with hard disc drives. A person in charge

"Borrowers will be able to carry their computers into a bank office and use them to negotiate a loan."

of, say, building a new school or hospital for a district will be able to find out precisely what the local residents need by examining the detailed profile produced by the microcomputer.

The network envisioned by Servan-Schreiber is beginning to take shape in various parts of the Third World. In Santiago, Chile, for example, the Latin American Institute for Transnational Studies is attempting to link up the microcomputers of several nongovernment research organizations in Argentina, Brazil, Chile, Mexico, and Peru. The project has the support of IDRC's Information Sciences Division. Who knows, this may be the genesis of that string of networks which will be able to unify and strengthen the initiatives of the developing countries.

What is promising in all this is that microcomputers seem to foster a greater will to communicate. Although it is unlikely that Servan-Schreiber's scenario will materialize exactly as he envisioned it, a large number of people have already taken steps to make it a reality for the benefit of the Third World. □

China's wonder tree

By CHIN SAIK YOON and GERALD TOOMEY



In the summer of 1985, Zhu Zhao-hua, a forest ecologist with the Chinese Academy of Forestry and an expert on Paulownia trees, became the first recipient of the "Man of the Trees Award", given by the Richard St. Barbe Baker Foundation, based in Saskatchewan, Canada. The award honours outstanding contributions to forest conservation, tree planting, and public education in forestry.

With a population of more than one billion, China is the most populous nation on earth. It has enormous requirements for food, firewood, and construction material, yet on average the land available to a farmer is only 0.1 ha. The Chinese consider every field and terrace of productive land a precious resource to be diligently safeguarded and meticulously managed.

In the past decade, a large-scale agro-forestry program aimed at increasing the productivity of farmland and the income of peasants — without jeopardizing the environment — has literally taken root across China. The centre of attention in this major "social forestry" project is a remarkable indigenous tree known as Paulownia. To date, almost 1.3 million hectares of China's farmland have been intercropped with this fast-growing broad-leaved tree, providing peasants with extra firewood, timber, and simultaneously improving crop yields.

A principal actor in this transformation of the Chinese countryside is 48-year-old Zhu Zhao-hua, a forest ecologist and a senior scientist at the Research Institute of Forestry of the Chinese Academy of Forestry, in Beijing. For more than a decade he and his colleagues, with the cooperation of Chinese farmers and local forestry officials, have been conducting research on many aspects of Paulownia: its natural distribution throughout China, characteristics and rate of growth, effects on microclimates and crop yields, propagation techniques, and susceptibility to insects and disease. A critical part of the research has been the selection, breeding, and testing of "plus" trees, strains with highly desirable

characteristics. The results of Zhu's Paulownia research are now being applied throughout China.

REQUEST FROM ARGENTINA

Although Paulownia trees have been grown in China for thousands of years, the story of their recent "rediscovery" begins not in China but in South America. "In 1972, an accidental opportunity aroused my interest in Paulownia," Zhu recalls. "From then on, Paulownia took almost all my energies."

The occasion was the attendance by China's minister of forestry, Liang Chan Wu, at a world forestry congress in Argentina. He was asked by some Argentinians to supply them with the seeds of two little-known species of Paulownia, *P. elongata* and *P. glabrata*. On his return to China, the minister asked Zhu to collect the seeds for him. "At that time, I didn't know much about Paulownia," Zhu says, "so I asked some very famous experts where the two species were distributed (located) in China. They couldn't answer my question."

Luckily, says Zhu, he found a reference to the two species in an old US journal and later was able to collect seeds. "When I went to Shandong and Henan provinces, I found that Paulownia trees grow fast, very fast, and that it can be intercropped with many crops such as wheat, corn, and cotton. Intercropping did not reduce crop yields and in some cases they even increased. I was surprised and encouraged."

The minister of forestry encouraged Zhu to publish his findings and follow up on his investigations. But the Cultural Revolution made research difficult. "Every project had been stopped and

many of our colleagues had become labourers living in the countryside with the farmers."

Despite the initial difficulties, Zhu made headway on his research. He began by looking for historical references to Paulownia and was fortunate to locate a number of old manuscripts on the subject, some dating back some 2300 years. "I also found a monograph, published in 1049, that was very scientific and useful," says Zhu.

Zhu ended up spending a year talking to many local people familiar with the tree and recording their accounts. The next few years he devoted to investigating the geographical distribution of Paulownia species, the climatic and soil conditions in which they grow, and how they were being intercropped. He also began planning a program to select superior trees for use in a country-wide Paulownia development scheme.

"I travelled alone all over China with a big, heavy bag full of plant samples," he recalls. "I visited 19 provinces. Some sites were in mountainous areas that were very difficult to reach." In the course of his work, he also discovered and named three new species of Paulownia.

Zhu published extensively on Paulownia and in 1974 collaborated with Wu Chung Lung, director of the Forestry Society of China, to form a national Paulownia research group.

SIX EXPERIMENTAL STATIONS

In 1979, the Chinese Academy of Forestry obtained financial support for a major Paulownia research project. Zhu and his colleagues established six experimental stations — one for each of

China's major climatic zones. These were exciting times for the researchers. The stations furnished them with the experimental base needed to breed and select, over the next few years, four high-quality clones from which two million root cuttings have been propagated for use by Chinese farmers.

IDRC began its support for Zhu's work in 1983. This has enabled members of the research team to obtain specialized training and to continue selecting species suitable for mass replication. About 850 "plus" trees from across China have been selected, grown, and tested for desirable characteristics such as superior height and diameter. The IDRC-supported work also included experiments on the intercropping of different species of Paulownia with food crops, and investigations of the effects of trees on the microclimate.

During the on-station research, Zhu and his colleagues gained expertise in propagating Paulownia trees. "For growing seedlings, we developed the 'high-ridge' method of culture," he says. This raises the ground temperature in the colder regions so that the root cuttings can begin to grow earlier in the spring. "The other method we use involves covering the ground with plastic sheets. In addition to raising the ground temperature, the plastic also helps control evaporation. We started experimenting with this method in 1983 with only 2 ha. By last year we had expanded to a total of 400 ha of nursery."

THE WONDER TREE

One day in the winter of 1983, Chinese leader Deng Xiaoping made a special

visit to the Paulownia Forestry Farm at Cheng Guan Commune in Shantung Province. "It was stated in the newspapers that Paulownia was a treasure," he said. "Today, I have alighted here to have a look at it."

Why is the Paulownia tree of such great interest to China's political leaders and forestry experts alike? Fundamentally, they see it as a wonder tree, a way to improve crop and wood yields, a new source of peasant wealth. Although the tree is not flood resistant and is susceptible to attack by insects and a microplasm disease known as Witches' Broom, its ecologically beneficial effects and ability to grow in most of China's climatic regions make it an attractive natural resource to nurture.

One of the most impressive traits of Paulownia is its growth rate. A 15-cm-long root cutting planted in the spring can reach 6 m by the end of the growing season, with average growth of about 2 m per year. And it is not uncommon for a 5-year-old tree to reach 17 m in height and have a trunk diameter of 30 cm, says Zhu.

Paulownia has a number of important uses. A 10-year-old tree can annually produce 30 kg of dry leaves and 400 kg of young branches which, being rich in protein, carbohydrates, and minerals, make good animal fodder. In view of China's serious shortage of firewood, the branches of the Paulownia are also an increasingly important cooking fuel.

China also has an inadequate supply of timber. Zhu estimates that if each person planted five Paulownia trees, local timber needs could be met. However, the naturally short stems of most of the nine species do not make Paulownia

ideal for timber. To overcome this problem, Zhu and his team have developed methods for improving tree shape by removing certain buds on saplings and encouraging the growth of others.

PAULOWNIA VERSUS WIND

Apart from timber, fuel, and fodder, a major benefit of Paulownia trees is their ability, when grown with crops such as wheat, to improve yields and soil fertility. The tree's deep roots help to condition the soil and retain its moisture, while dead leaves act as fertilizer. The trunks and large crowns of the trees provide shade, protect the soil from wind erosion, and shelter crops against desiccating winds.

In the Yellow River Basin, where wheat accounts for 40 percent of all crop farming, the hot dry winds coincide with the May harvest and can reduce the yield by up to 40 percent. Intercropping with Paulownia has proven effective in eliminating these losses. Experiments have shown that the relative humidity of the air above fields intercropped with Paulownia is 7 to 12 percent greater than in open fields. This is due to evapotranspiration. The air temperature is 1 or 2 degrees Celsius lower, and windspeed is cut by 30 to 50 percent, depending on the spacing of the trees. These microclimatic differences make for better growing conditions.

Paulownia can also be intercropped with maize, millet, a variety of vegetables, and even cotton, although in this last case, the yield increases only if the weather is dry.

YIELD DEPENDS ON SPACING

The spacing of the Paulownia trees is a major determinant of crop yields. For example, if trees are grown 5 m apart, with 10 m between each row, then the yield of wheat is the same as for open-field cultivation. When the distance between the rows of trees is increased to between 20 and 40 m, however, the crop yield goes up 7 to 10 percent.

In the 1970s, the land intercropped with Paulownia in China totaled only 20 000 hectares. Today it is almost 1.3 million hectares and the dissemination of this forestry technology is proceeding on a large scale through propagation and training programs.

As the son of a peasant forest ranger, Zhu Zhao-hua spent his childhood in the forests of Chekiang Province surrounded by bamboo and fir. The greening of China is, for him, a dream come true. His winning of the international "Man of the Trees Award" recognizes the power of such human endeavour. □



These towering Paulownia trees, intercropped with wheat, are only four years old.

Co-author Chin Saik Yoon is regional liaison officer for IDRC's Communications Division. He is based in Singapore.

Señor de los Milagros, literally "Our Lord of the Miracles", is a poor district in the north end of Lima, Peru, squeezed in between the heavy industry along the banks of the Rimac River and the airport. The children run along the alleyways with little plastic pots in their hands. They are off to the "comedor popular", a canteen run by the women of the community.

In exchange for a ticket worth 1000 soles (about 6 cents Canadian), they will fill their containers with vegetable or rice soup sprinkled with quinoa. A number of women also show up to carry away five or more servings each for their families. Certainly they'll get a rather modest meal, but at least it will be a nourishing one because a protein-rich mixture of potatoes, cereal, and vegetables, called M-6, is added to every dish served.

Peter Keane of the International Potato Center in Lima is a specialist in developing food products. Coming from Ireland, he knows a great deal about potatoes, which are the staple food of the Andean populations. Thousands of years ago, he explains, the highland Indians developed techniques for preserving potatoes. One traditional method is to dry them by exposing them alternately to frost and to sunlight. The result is a lightly fermented product used to make "carapulcra", a stew much favored for festivities or marriages.

A number of years ago, a research station at Huancayo in the Andes, operated by the International Potato Center, developed a product similar to traditional dried potatoes. Potatoes are washed, peeled, cooked, and grated, then put out to dry in the sun. Although this product is a little different, because it is not fermented, it seems to please the public. However, it has never managed to establish itself in the market. To begin with, potatoes contain a lot of water, about 76 percent, which makes dehydrating them slow and costly. Another problem is that second-grade potatoes, which are preferable for the purpose, are not always readily available and their prices are often above those for rice and beans which compete with commercial dried potatoes.

HIGH-PROTEIN MIX

Keane had the idea of mixing dehydrated potatoes with cereals and dried vegetables. He went to great lengths to find the mixture with the highest protein content at the lowest cost. "I'm not the only one who has suggested such mixtures," he points out. Other dried products have been developed but have usually run into problems, he says, adding that this is no reason to abandon research. "Any new dried product is bound to compete with other dried foods

JUST ADD POTATOES

ENRICHING THE PERUVIAN DIET

By ROBERT CHARBONNEAU



Take-out food: Inexpensive meals from a community canteen in Lima.



This young Peruvian's soup is enriched with a nutritious potato-based mix.

Photos: Robert Charbonneau, IDRC

such as rice or beans, so we must be able to sell it at an attractive price."

Nutrition research on the Andean region done by the FAO in 1973 shows that tubers, cereals, and vegetables are the basic elements in the diet of the population. Tubers and cereals, in fact, supply 88 percent of caloric intake and 76 percent of the protein consumed by Andean peoples.

Keane's M-6 mixture corresponds perfectly to these nutritional patterns. It contains 60 percent dehydrated potatoes, 32 percent local flour (rice, oats, and barley), and 8 percent beans. With the help of FAO's tables of nutritional equivalence, it can be shown that, of the 24 mixtures tested, this one supplies the greatest nutrition for the least money. It is 86 percent protein. It is also relatively easy to produce, remains stable when stored, and keeps its nutritional value for a period of up to six months. Before being eaten, the mixture has to be boiled for 25 minutes. This further protects it against bacterial contamination.

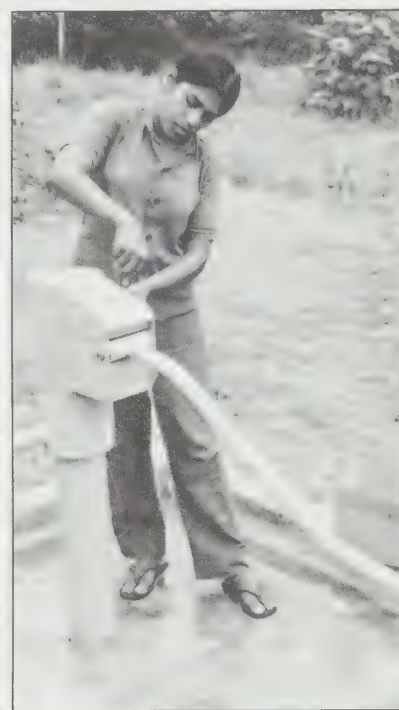
Over the past two years, tests of M-6 mixture have been conducted in 12 "comedores populares" in Lima, in collaboration with the World Food Programme. Peru's National Ministry of Health has also used it to improve the nutritional quality of the brew served up during the 10 a.m. break to the 360 children at a primary school in Huancayo, in the Andes. Since August 1983 an in-depth study has been in progress at the Señor de los Milagros canteen to see how well the product is accepted by the population and evaluate improvements in the state of health of those consuming it.

"It was our intention," says Keane, "to propose a semi-finished product, neutral in taste, so that consumers could invent their own recipes and improve the nutritional value of their meals. And it worked. Cooks found more uses for it than we could ever have imagined. They eat it with chicken, beans, or cheese, thicken soups with it, make stews, enhance its flavour with onions, garlic, or spices. They even use it for making desserts by mixing it with milk, brown sugar, cinnamon, and cloves."

"Cooks found more uses for it than we could ever have imagined."

IDRC made it possible to develop and test the manufacturing methods on both the industrial and household scales. Seven families in three villages in the Huancayo region have learned how to become self-sufficient and produce the mixture for their own consumption. Non-government and international organizations are holding preliminary discussions for the eventual setting up of five small factories in Peru. This would offer the producers of second-grade potatoes a new market, and it would also make available a new, inexpensive nourishing food to new immigrants in Lima. □

Robert Charbonneau is a writer in IDRC's Communications Division.



WOMEN AND W

If the goal of the International Drinking Water Supply and Sanitation Decade is to be realized, handpumps that can be manufactured locally and maintained at the village level are needed — 20 million more by the end of the century.

In a number of countries in Asia and Africa, the leaders of water development projects have decided that since women are usually the ones who fetch water,

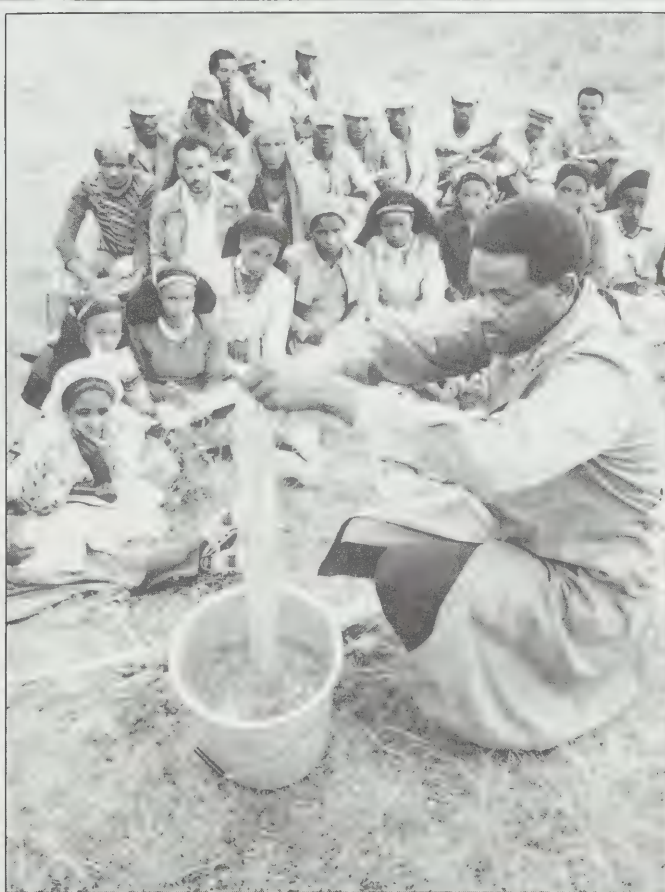
they should take charge of new water technology.

In Thailand, the Population and Community Development Association is teaching women in the impoverished Northeast region how to maintain a handpump designed at the University of Malaya. They are finding that village women, using simple tools, can easily carry out preventive maintenance and

minor repairs on this light-weight, plastic pump.

The Ethiopian Water Works and Construction Authority is now manufacturing and testing its own handpump and village women are learning how to maintain their new technology in short courses and on-the-job training.

In all these IDRC-supported efforts to help women pull themselves out of the



Clockwise from top centre: Pumping water from a deep well in Maki, Ethiopia. The pump is based on an IDRC prototype. In the Bale region of southern Ethiopia, men and women are all eyes and ears during training in handpump maintenance. In Sri Lanka's dry eastern region, a woman welds a pump in a Sarvodaya workshop while another carries out a little maintenance. Technicians from the Population and Community Development Association (PDA) in Thailand's Buri-ran Province use a special demonstration pump with piston and foot valve in full view to explain the principle of operation to handpump "caretaker" trainees. A PDA research assistant from the Population and Community Development Association (PDA) interviews a villager (woman at spinning wheel) about handpump usage. A Sri Lankan woman instructs villagers on handpump use and discusses health concepts with them.

WATER

Photos and text by Neill McKee

drudgery of centuries, the most progress has been made in Sri Lanka where the Sarvodaya Shramadana movement has involved women not only in maintaining pumps, but also in manufacturing all of their above-ground components.

In Sri Lanka's dry zone, 20 village women have learned the basics of metal working and mechanics in village workshops. In addition, pump attendants are

stationed in a number of smaller workshops near the pump installations where they can carry out preventive maintenance and, at the same time, earn a living by making small tools for the village.

The value of and respect for Sarvodaya's "women of the handpump" has increased tremendously. New applications for employment arrive every day. Sar-

vodaya hopes this is just the beginning of a much larger movement to train women to take the delivery of water, and their destiny, into their own hands. □

Neill McKee is IDRC's film producer-director. He has just completed a film on handpump technology which examines the role of women in water delivery projects in several countries.

WATER FROM THE SUN

DESALINATION IN THE KALAHARI DESERT

By GERALD TOOMEY



Photo: Gerald Toomey/IDRC

Technicians install 'Mexican' stills to help cope with drought in Botswana. Solar energy converts saline groundwater into potable water.

Shading himself from the growing intensity of the late morning Kalahari sun, Batswisha Tswiega relaxes under a parched acacia tree. He is sitting nearly motionless in an old green wheelbarrow with a flat tire. A few hundred metres beyond the edge of this tiny Basarwa village, called Loghware, a flat glass surface glints in the harsh sun.

This is south central Botswana, just below the tropic of Capricorn. Though the pervasive African drought has not been as severe here as in Ethiopia and the Sahel, it has made itself felt nevertheless.

With its deep sand, low savannah brush, and paucity of trees, the Kalahari Desert is, at the best of times, a harsh environment. Summer day temperatures reach as high as 45°C, winter nights a chilling -5°C. But it's here that the diminutive Basarwa make their home. Their traditional nomadic life was dramatized in the recent South African feature film, *The Gods Must Be Crazy*. In the film, the pilot of a passing aircraft drops an empty Coke bottle in Basarwa territory. The hard, shiny glass is a novelty to the "Bushman" who finds it and puts it to a

multitude of uses. But the bottle disrupts his family so much that he resolves to go to the end of the world and throw it away.

These days, the Basarwa (as they prefer to be called) are more likely to travel to the end of the world for water.

Years of drought have made the Kalahari a more forbidding place than ever. In the past, painted ostrich eggs like the one hanging in Tswiega's tree held water for far-ranging Basarwa hunters. The soil retained sufficient moisture after the infrequent rains to support sip wells, reservoirs from which the Basarwa could suck water using long straws. Now they get their drinking water when the district council water truck rumbles into the village once a month. And when that supply is exhausted, they must travel to another village for water.

The Basarwa are nomads no more. Like Tswiega and his 125 fellow villagers, they have settled into semipermanent communities around reliable sources of water and game.

Three visitors gather around Tswiega's wheelbarrow to discuss water and the glinting glass structures beyond the village. They have come from the Rural Industries Innovation Centre (RIIC) 300 km

to the southeast and the glint in the harsh sun is a prototype solar still for desalinating water.

TEN-HOUR TREK

Switching between English, Sesarwa (the tongue-clicking Basarwa language), and the regional Sekgalagadi language, the visitors and Tswiega discuss water and the lack of it. Tswiega tells the visitors that there are two adults and four children in his household. When his meagre 5-litre (L) supply runs out, he borrows a 25-L container from a neighbour and travels with a donkey to the village of Kokong to fetch fresh water. It is 16 km away and he or a family member makes the trip several times a week.

"How long does the trip take?" asks Judge Tlhage, an RIIC field officer who speaks Sekgalagadi. Tswiega reflects a moment and points to two positions in the sky — where the sun is when he leaves, and when he returns. The journey there and back takes 10 hours.

The irony is that only 2 km away on a desert pan is a borehole with a diesel motor that pumps plenty of water. It is managed by the district council. But the

water is salty — not nearly as saline as seawater but unsuitable for drinking. The villagers use it for watering goats and donkeys, for washing and cooking, but people who drink it get diarrhea. About half the wells in the Kalahari are saline.

FAMILY SURVIVAL FIRST

The glass-topped solar stills, which use solar energy to remove salt from the borehole water, may reduce the number of trips to Kokong but the transition to this new technology is proving to be a strain on personal relations. Though considered by most to be community-minded, the Basarwa put family survival first. Says Teedzani Woto, a sociologist and co-leader of the desalination project, "In fact, they are quite individualistic and are concerned with getting enough water for their families. Some people even go to the stills at night when no one is

problem of social organization continues to be a critical variable in the water equation.

Still designer Roger Yates, project co-leader with Woto, agrees that group administration is a problem. The Basarwa, he explains, do not necessarily deal with misunderstandings by working out a solution among themselves. "As soon as there is an argument brewing," says Yates, "one side simply moves away." By installing stills that require people to follow maintenance and distribution procedures, the research team is, he says, "introducing rules to a 'no rules' society". The link between the new technology and villagers' behaviour is an issue the researchers are looking into.

The project leaders have set themselves a difficult task — to make several villages water-self-sufficient through solar distillation. "If the district council only has to send a truck every two

2.5 L of drinking water per person per day. (Drinking water is prepared by mixing distilled water with a little saline water to maintain mineral requirements.)

SIMPLE... YET COMPLEX

Much of the practical research work centres on the stills' cost and efficiency. While solar distillation technology is theoretically simple, a great deal of experimentation is required to produce a design that can be built locally and inexpensively, can endure the harsh Kalahari environment, and is easily maintained and accepted by the villagers. As with many "appropriate" technologies, the simplicity of the eventual solution belies the complexity of product development.

Though efficient, the test designs are still too expensive to be the long-term answer for Botswana's remote communities, in Yates' estimation. Cost reduction is the next task but, meanwhile, it's important to "wean the villagers off council water" with the assistance of the present designs. Then, attention can be directed to distribution and related problems.

Whether or not the 'gods' of technology really are crazy is a subject for sober reflection. But at least now, when the 'Bushman' encounters a peculiar glass object in the desert, it will provide him with something to drink — precious water. □



Painting a still's basin black increases the water temperature for greater efficiency.

around." Despite difficulties, the villagers are very interested in the 12 new solar stills constructed by RIIC. (See box.)

"WE LIKE THE WATER"

The villagers using the stills like the taste of the water and see the value of the new source. "I got my first bucket from the stills just last week," says the village headman, Habathwe Katau, an hospitable old man clad in a tattered red shirt and a green leather hat. "We like the water." Katau is also able to store 200 L of council water each month, but even he would like more — 200 L a week would be about right, he says.

The villagers' enthusiasm is tempered by concern that the distribution is not fair to all. About half the people have not yet taken advantage of the new water source, in part because they are unsure of their rights to it. A visit to other households confirms this problem. Some people believe that the man in charge of maintaining the stills and distributing the water is giving preference to friends and relatives. Despite the village discussions organized a few months earlier to explain the stills' workings and how water was to be shared, uncertainties persist. The

months instead of every month, then we're getting there," says Yates.

Loghware is only one of several sites where RIIC, with IDRC support, is experimenting with solar desalination. Another is the more isolated and ethnically mixed village of Khawa. Desalination technology has proven to be more successful there than in Loghware, mainly because community participation has been stronger and the villagers are more adept at bricklaying and other skills needed on the project. Distribution problems, however, are also occurring in Khawa.

RIIC is testing a number of desalination devices, including wood-burning stills. But the solar devices are particularly promising because they can tap the sun's abundant energy. Wood burners have the advantage of producing distillate quickly, but consume large quantities of increasingly scarce firewood. For this reason, they seem better suited for emergency use.

The main solar desalinators being installed and tested by RIIC is a double-paneled design with a fibreglass body, known as the "Mexican" still. It can produce up to 4 L of distillate a day in winter and up to 8 in summer. The RIIC researchers hope to install enough stills to reach their target production level of

GLASS HOUSES IN THE DESERT

The Mexican stills being installed and tested by the Rural Industries Innovation Centre in Botswana look like miniature greenhouses. Each still covers an area of about 1.6 m², comprises two panes of glass, a supporting cross-piece, a fibreglass body with an insulated basin, and outlet pipes.

The shallow black basin is filled with saline water, which solar radiation heats to as much as 75°C in the desert sun. The hotter the water, the faster the rate of evaporation. The water vaporizes leaving the salt behind in the basin. When the vapour comes into contact with the cooler glass, it condenses as a thin film of distilled water which then slides down the glass into the troughs on either side of the still. The distillate flows from the troughs through pipes to a central collection vessel located in a sunken concrete tank.

Tests indicate that the Mexican stills are performing well, with their efficiency ranging from 44 to 52 percent. This compares favourably with ratings of other basin stills elsewhere in the world.

RUGGED RESERVOIRS

RAIN CATCHMENT IN THAILAND

By DENIS MARCHAND



Left, a 14.5 m³ reservoir. Dr Chayatit estimates that one person drinks 1 m³ of water during the dry season. Top, brickmaking is feasible even as a one-person operation. Right, mortar bricks for building reservoirs, wells, fences, or even terraces.

The 15 million inhabitants of the northeastern region of Thailand have a serious problem with their drinking water supply. The arid red soil here has a high mineral content which gives well water a bad salty taste. Even worse, the water becomes contaminated because of the poor hygiene of the people who also raise cattle within the confines of the village.

This region, regarded as the poorest in the country, contains about a third of Thailand's population and area (140 000 km²). It has two seasons, the rainy season from May to October, then a hot dry period for the remaining seven months of the year.

For most peasants, the most rational solution to the water supply problem has always been to drink rainwater. From time immemorial, people have set out earthen jars beneath the eaves to catch rainwater which they store for use during the hot dry season. The system is purely artisanal and not very efficient.

In the last 10 years, however, the government has been providing an alter-

native water supply system. It has constructed no less than 20 000 bamboo-reinforced cement reservoirs for rain catchment to supply drinking water to farmers in the northeastern region. But a serious problem has arisen: some reservoirs are cracking; in fact, with a third of them out of service, the whole program is in jeopardy.

With financial support from IDRC, a research team led by Dr Chayatit Vadhana-vikkit of the Civil Engineering Department of Khon Kaen University went to work on this perplexing problem.

When Dr Chayatit analyzed fragments in the laboratory, he discovered that the cement was of good quality and had retained its strength. But the reinforcing bamboo pieces had rotted, demonstrating that they were not suitable for use in reservoir construction. Bamboo is not sufficiently elastic to withstand the water pressure and does not stand up well to moisture and bacteria, losing 90 percent of its strength within two years.

White ants, termites, rats, and rot often attack bamboo, so builders treat it chemi-

cally. This adversely affects the flavour and sometimes the quality of the water.

Bamboo has been used as a reinforcing material because of the high cost of steel. A cement and bamboo reservoir usually costs CAD\$220, compared with \$275 for cement and steel. Savings like this are important in an economy where the annual wage rarely exceeds \$750.

One person can easily make the blocks and assemble a reservoir.

"The research we did first permitted us to determine what caused the breakage and then led us to develop a new construction technique," Dr Chayatit explains during a tour of a brick-making workshop on the university campus.

"Look at the bevelled-end design of these mortar blocks; it makes it possible to fit them together to make the structure strong and firm. They are called 'interlocking blocks'.

"I think we have found a simple, inexpensive, efficient and solid alternative solution. There is no need for any additional reinforcing material and the system is the most practical one could find for a poor region," says Chayatit. He goes on to explain that one person alone can easily make the blocks with sand, mortar, and a mold, and assemble a reservoir of whatever size best suits the family's needs and financial situation. Using mortar blocks reduces the cost by 30 percent.

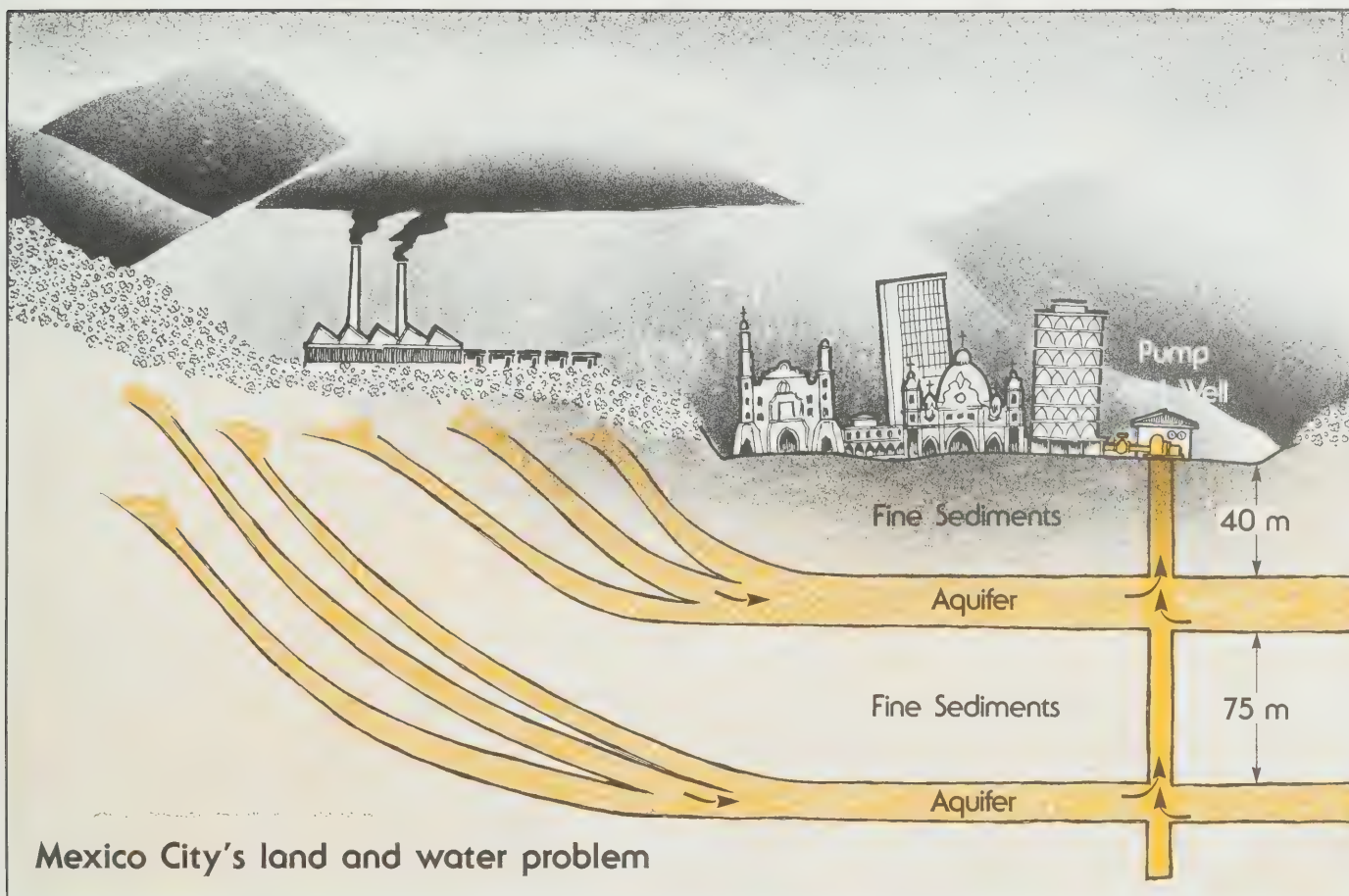
Reservoirs usually contain between 9 and 14.5 m³ of water, enough for the normal domestic needs of a six-person household for seven months, the duration of the dry season. Twelve of the new reservoirs have been installed in various villages and, after 18 months of use, they seem to be working well.

"This new construction technique is based on local skills," says Chayatit. "We managed to put our own knowledge to use to meet the real needs of the environment. Not only is the system entirely appropriate but the bricks can be used for other purposes such as building enclosures or terraces. This is not something we import but rather a local product, and I am very proud of it."

Denis Marchand is a freelance Canadian journalist. He recently visited Asia under a project sponsored by the Fédération professionnelle des journalistes du Québec and funded by the Canadian International Development Agency.

DWINDLING WATER IN THE SINKING CITIES

By DANILO ANTON



Mexico City's land and water problem

Aquifers, composed of gravel and coarse sand, are recharged naturally by water from the high ground. Excessive pumping depletes them and forces the water trapped in the fine sediments to flow into the aquifers. This loss of water causes the sediments to compact

and the city land above them to sink, causing some buildings to shift and making them especially vulnerable to earthquakes. To make matters worse, polluted water from residential suburbs and industrial areas seeps into the aquifers.

The giant cities of Bangkok, Shanghai, and Mexico City are literally sinking and they face increasing difficulties with their water supply. Their major source of domestic and industrial water lies directly beneath them in the form of strata of permeable rock, sand, and gravel called aquifers. But the volume of water in these formations is steadily decreasing. A major disaster seems inevitable.

In these three cases, increased and concentrated pumping has considerably lowered the water table and led to the compaction of an important part of the sedimentary surface covering. As a result of the reduction in volume of water in the underlying aquifers, the soil has sunk several metres in those zones where compaction is most serious. Generalized subsidence has created serious flood problems in Bangkok and

Shanghai, cities only slightly above sea level. In Bangkok, where the average elevation is less than 1 m above sea level and tides can rise above that, the rate of subsidence is as much as 12 cm a year.

Some Third World cities that depend directly or indirectly on their underground water face an additional problem where the recharge zones are in areas of urban and industrial development, or in areas of intensive agriculture. Since controls for disposal of sewage and industrial wastes are not usually very strict, local contamination of aquifers is rather common. For example, in Mexico City's neighbourhood of Xochimilco, it has been necessary to close several wells because of an excessive concentration of nitrates in the water, possibly due to pollution from the Chalco Channel which transports urban sewage. In the case of agricultural zones, the recharging of aquifers

can introduce highly toxic pesticides and herbicides to the hydrogeologic system.

MORE RUNOFF, LESS RECHARGE

All of these phenomena tend increasingly to affect the quality of fresh water in large cities and surrounding areas. In addition, urbanization and agricultural over-exploitation seriously affect the recharge characteristics of the aquifers. Superficial runoff frequently increases, affecting not only the agricultural productivity of soils (due to surficial erosion) but also the integrity of roads, bridges, and other structures, due to the catastrophic increase in the volume of river water during flood periods.

The increase in the amount of runoff flowing into the rivers, then, is preventing water from infiltrating the ground to replenish the aquifers. Accordingly, the

renewability of the aquifer is adversely affected and the quantity of available water is reduced precisely where it is needed the most.

Although the seriousness of these phenomena is evident, the lack of information — and in some cases insufficient study of available information — prevent management decisions from being made which would alleviate the potentially disastrous effects of this situation.

THE CASE OF THE MEXICO VALLEY

A concrete example of environmental imbalance due to a complex history of man-made degradation of a basin can be seen in the Mexico City area.

The Mexico Valley, or Anahuac, is a basin of approximately 2000 km² surrounded by volcanic mountains located on the Mexican central plateau at an altitude of 2000 to 2500 m above sea level. The bottom of this basin was originally covered by a system of more or less interconnected lakes covering an area of about 500 km². Around these lakes there settled and developed an indigenous society whose livelihood was based on the cultivation of corn. Tenochtitlan, the capital of the Aztec empire, was built on a partially artificial island close to the western shore of the valley's main lake,

Texcoco Lake.

The expansion of Mexico City, built on the ruins of Tenochtitlan, led to the gradual occupation of neighbouring bays and lowlands until the city finally encompassed a great part of the lake area. Due to difficulties with urban drainage, a channel was built in the early 20th century which finally drained most of the lake. This operation, however, was not entirely successful, since the dry lake bottom was transformed into a kind of chemical desert because of the extreme alkalinity of the soil (its pH is greater than 10). Since then there have been hazardous dust storms ("tolvaneras") associated with the northeastern winds.

The drying of the lake eliminated a major source of the city's fresh water just at a time when a demographic boom was beginning, a boom that pushed Mexico City's population from one million people in 1930 to more than 18 million in 1985.

As an alternative, the city had to collect surface water (mainly from the Lerma River basin) and use pump-equipped wells installed in the underlying aquifers. (See illustration.) The continuous and increased extraction of water from wells led to a rapid decrease in the piezometric surface, that is, the level to which water naturally rises due to the aquifer's pres-

sure. At the turn of the century, many wells were artesian (naturally flowing out of the ground); nowadays the water level is several metres deep throughout the area.

The increase in the amount of runoff flowing into the rivers is preventing water from infiltrating the ground to replenish the aquifers.

The recorded annual rate of subsidence due to excessive pumping is several centimetres, for a total of more than 1 m over the last 30 years. The sinking of the valley bottom shows that there is a strong deficit in the system's hydrological balance. Annual consumption reaches some 300 million m³, but it has been estimated that the recharge rate is less than one third of that.

WATER SHORTAGES

If water consumption continues at the present rate, the aquifer will be depleted within a relatively short period of time, thus exacerbating water shortages. Exactly when this will occur is not yet known.

IDRC is supporting efforts to formulate, study, and solve these problems. (See box.) Recently, it approved an ambitious joint project to study the Mexico Valley problem and propose solutions to it. This project is being conducted by the Groundwater Research Institute of the University of Waterloo, in Ontario, Canada, and the Universidad Nacional Autónoma de México (UNAM). The research team's objective is to characterize the valley's underground waters to determine the renewability of the aquifer and any possible sources of pollution. The Waterloo and UNAM teams will use sophisticated isotopic and hydrogeochemical methods, as well as hydrogeologic mathematical models developed specifically for this particular case.

It is expected that this project will bring important benefits to Mexico City and neighbouring areas. For one thing, it will tell planners and decision-makers what pollutants are already in their drinking water. Perhaps even more important for the inhabitants of this city, whose population is expected to reach an astounding 30 million by the end of the century, the project results will give them a good idea as to when they will run out of underground water. □

Daniilo Anton is a program officer (Earth Sciences) in IDRC's Cooperative Programs Division.

JOINT EFFORTS

IDRC is supporting a number of collaborative research projects on underground water in developing countries:

- In Bangkok, Thailand, a joint interdisciplinary team from the Geotechnical Research Centre of McGill University in Montreal, Canada, and from the Asian Institute of Technology is studying the present and future effects of water pumping in several suburban areas of the city.

This study will examine the relationship between pumping and subsidence and provide some of the information required by the authorities to make decisions regarding future urban expansion.

- In Montevideo, Uruguay, a joint team from the Université du Québec à Montréal and the Dirección Nacional de Minería y Geología del Uruguay is about to begin a study of the influence of agricultural practices and urban expansion on the most important Uruguayan aquifers in the Santa Lucia River basin. This project will assist in evaluating the potential of those layers to supply Montevideo and its surrounding districts in the future.

- In Cotonu, Benin, the same Canadian team, in cooperation with the National University of Benin, is studying the hydrogeology of aquifers in the densely populated southern region to solve the problem of increased salinity of underground water. The results of the study will provide information useful in territorial planning and the provision of water in the future.

- A joint team from the University of Sherbrooke, Canada, and the National School of Engineering of Sfax, Tunisia, is conducting a study of the surface and shallow layers of this Mediterranean city in order to determine criteria for future territorial planning from a hydrogeological and geotechnical point of view. The city of Sfax has serious urban problems resulting from uncontrolled expansion in unsuitable areas.

All of these projects tend to emphasize an area of specialization with good potential for cooperation between Canada and developing countries. The studies are expected to lead to the establishment of a network of scientists and institutions specializing in hydrogeology and related fields.

AGUA DEL PUEBLO

TAPPING A MOUNTAIN STREAM IN GUATEMALA

By STEVEN HUNT

Young girls are playing tag in the school yard of the small Guatemalan village of San Martias, 70 kilometres north of the capital. The game centres on the water faucet. If tagged, a girl must run to the faucet, take a sip, and then try to tag someone else.

There are now 86 water faucets connecting the village to a mountain stream. Most are close to the villagers' homes or in public places such as the schoolyard. Agua Del Pueblo (ADP), a Guatemalan rural water and sanitation program committed to developing self-reliant communities, was a major actor in this important village improvement scheme.

Inside the schoolhouse, village leader Felix Xujur says that before Agua Del Pueblo (literally, "Village Water") agreed to work with the community, the women and children walked for two hours each day to a mountain stream to fetch water. "Now they don't need to walk so far and we are all healthier as well."

While other water development organizations may simply provide a water system, ADP works with the community to develop the skills necessary to maintain the water system and useful for other projects.

The supply of inexpensive and safe water to village communities is of prime importance to rural Guatemala. Only one village in 10 has a latrine or a safe supply of drinking water. Half of all children in

Only one village in 10 has a safe supply of drinking water.

in village hygiene in order to attain the most from a new water system. Health is compromised by poor hygiene regardless of water quality. The building of latrines and participation in courses on basic hygiene, then, are also conditions of ADP's involvement.

San Martias is a typical small Guatemalan village tucked away in the moun-

mittee to help coordinate the construction work. Loans were worked out by the committee so that each family understood what it would owe each month.

VILLAGERS DO REPAIRS

The villagers have themselves carried out most of the repairs since the system was built. Some were trained during the construction of the water system and ADP's technicians had to be called back only once to fix a major valve.

ADP hires its technicians from rural Guatemalan Indian communities. They can thus understand and relate to villagers' experience better than the urban technicians of other organizations. The technicians train for six months in water system construction methods.

An IDRC-funded study of the technicians' six-month course found the technicians had excellent technical skills upon graduation. Requests for courses have been received from El Salvador, Honduras, Peru, Ecuador, and Costa Rica.

"Despite the emphasis we place on education and health," says ADP's project administrator, Leonel Cabrera Meza, "we find it's still not enough. Good health habits are so important for the development of the village."

The village of San Martias is quiet now as Felix Xujur and Patricio Dorix walk out of the schoolhouse. Felix points to a house where the women inside are making tortillas over a fire. "Almost every house like that one has a water faucet," he says.

"We learned much from ADP and since we've built the water system we have organized the building of that school we were in. But most of all we're healthier." □

Steven Hunt is an independent writer/broadcaster based in Ottawa.



Photo: Steven Hunt



In San Martias, clean water now makes for healthier children.

the rural areas die before the age of five from water-borne diseases or as a result of poor sanitation. Two thirds of the children suffer from infectious diarrhea which remains the most common illness.

According to the World Health Organization, in most small towns and villages in rural areas, "more health benefits can be gained from money spent on a water supply program than in any other way."

Unlike other organizations, ADP demands community involvement in all aspects of construction because this increases the probability that the water system will continue to operate. A 1979 study of 34 Guatemalan villages' water projects built over the previous 15 years found village participation essential to keeping water systems working.

But there must also be major changes

tains several kilometres from the main highway. It began its search for a water development organization in 1981. "We heard about Agua Del Pueblo and they agreed to build a water system if the community shared the cost and provided labour and material," says Patricio Dorix Quelex, another village leader.

Agua Del Pueblo's technicians inspected a mountain stream several kilometres from the village and found that its water was safe to drink and that it was feasible to build a gravity-fed water system. Because of women's central role in family health, they had the task of selecting sites for the taps.

ADP technicians used pictograms to teach the villagers the relationship between health and hygiene. They also helped the village to form a water com-

KANO'S COWPEA REVOLUTION

By GUN LUNDBORG



Photo: Gun Lundborg

Kano farmers with cowpea harvest. Southern demand is expected to absorb the surplus.

Nigeria's State of Kano, on the fringes of the Sahel, is undergoing an agricultural revolution and one of its major ingredients is a high-yield variety of cowpea called TVx 3236.

Not so many years ago Kano State decided that something had to be done to rescue its agricultural development. The goal, as expressed by the former Governor Alahaji Abdu Dawakin Tofa, was "the total emancipation of the common man from hunger, disease, poverty, and squalor".

So the Kano Agricultural Research Development Authority — KNARDA — was established. It is a multi-million dollar joint venture between the Federal Government and the World Bank. Despite economic difficulties that will likely result in less money being spent than originally anticipated, KNARDA is nevertheless one of the most ambitious projects of its kind in the world and Africa's largest rural development project.

KNARDA's work embraces the whole of Kano State — some 4.3 million ha and almost one million farm families. Among its many goals are the improvement of infrastructures, the promotion of integrated farming systems (irrigation, livestock, etc.), and the application of a new extension system. KNARDA wants farmers to be self-reliant and to make their own decisions. "We do very little free for the farmers," explains Simon Gillet, one of KNARDA's four zonal managers. "They

pay for the seeds, the pesticides, the pumps."

CLOSE TO SUPPLIES

Working closely with KNARDA is a special service called KASCO, which operates 170 retail outlets around Kano State. It ensures that farmers are close to supplies of seeds, fertilizers, chemicals, small implements, livestock, and domestic goods for their families. It also provides tractor services such as ploughing, harrowing, and ridging when the farmer can afford it.

Under KNARDA, agricultural extension has been decentralized. As their name suggests, the "village extension advisors" (VEAs) live in the village with the farmers. They train the farmers, take them to demonstration plots, discuss farming with them, and get to know them. In Kano, the extension worker needs good boots more than a shirt and tie! At present, KNARDA has about 500 VEAs, but that is expected to increase eventually to 1500.

"I think Kano State is taking the first steps of an agricultural revolution comparable to the European agricultural revolution of the 18th century," says Gillet. The leading edge of this rural transformation is cowpea cultivation.

The intercropping of cowpeas with sorghum and millet is traditional in this part of the world. In fact, they were the first crops to be grown in a primitive farm-

ing system introduced some 10 000 years ago. Today, they still occupy a primary position in Nigeria's agriculture.

Nigeria is the world's largest producer of cowpeas and 80 percent of the country's harvest comes from the northern states of Kano, Sokoto, and Borno.

Local varieties are more useful as groundcover — they help retain soil moisture and fix nitrogen — than as good grain producers. The classic cowpea is a viny, sprawling plant with good tolerance to disease, insects and adverse climatic conditions. But its yield is low, only 200 kg/ha.

Nigeria is the world's largest producer of cowpeas.

Last year, a new variety of cowpea grown by 10 000 Kano farmers turned statistical estimates topsy-turvy. It was released a few years ago by the International Institute of Tropical Agriculture (IITA) in Ibadan under the name TVx 3236. Multiplied and distributed by KNARDA among smallholders in Kano State, it has changed the landscape, production systems, and the former pessimism of farmers.

TEN TIMES THE YIELD

"The farmers have quickly become accustomed to the miracle of high-density, sole-crop sprayed cowpeas," says C. Harkness, another zonal manager of the project. With yields sometimes 10 times greater than that of traditional cultivars, TVx 3236 is clearly a profitable crop to grow. The farmers have nick-named it "Dan Knarda", which in the Hausa language means "Son of Knarda".

Habu Kadiri Hoperator is a farmer who planted a little less than a hectare of the high-yield cowpeas last year. "What is left when my family and I have eaten enough I'll give to my neighbours who have seen the cowpeas in my field and want to grow Dan Knarda themselves next year," he says.

But what will happen to the high price of cowpeas and to farmers' incomes as the growing surplus makes its way into the marketplace? Simon Gillet is not worried about increased production: "We do nothing about marketing as such, but know that much will be absorbed in the South where production continues to be scarce."

The price of cowpeas on local markets is still very high, but even if it drops, as it is expected to in the near future, the farmers of Kano should still be left with a fair profit. □

Gun Lundborg is a freelance development journalist and contributing writer to IITA. She is based in Rome.

In N'Zikpli, a small village without electricity in central Ivory Coast, the elders of the community were asked about what they had learned from the battery-powered television set the government had installed in the local school in 1974.

After explaining, through an interpreter, that they had learned a lot about life outside the village, the men were asked if they had any questions about what they had seen. The chief was the first to speak: "Is it true that the white man can fly without wings?" Asked another man: "Why are whites always stabbing, punching, and shooting each other?"

Two decades ago TV was thought to be the miracle needed to solve many of Africa's problems. It was to be the new oracle, the catalyst necessary to usher the continent into the mainstream of 20th century life.

What has happened to television since then? Is it being used to its full capacity to aid development? If not, how can it be made more effective? What is the future for this potent medium in Africa?

With these questions in

THE MAGIC MULTIPLIER

TV offers a number of advantages to nations where there is a need for rapid development of education and the communication of information on development. It has been referred to as "the magic multiplier" and can be an inspiring teacher when used in the nonformal education of adults.

TV has the potential of reaching large numbers of people and making development goals universally known. Because of its combination of audio and visual components it can be used to communicate relatively complicated messages to illiterate audiences. Television with its captivating message and ability to inform masses of people provides African villagers the same potential as farmers in India or the Canadian Inuit for making the transition from a traditional society to a modern one.

Despite this potential, television's record as an educator and instrument for effecting changes and progress in Africa is a dismal one. The medium has not lived up to its promise of enlightening and

TELEVISION IN AFRICA

DISAPPOINTMENT ... AND HOPE

By IAIN McLELLAN

Iain McLellan, a Canadian journalist, recently completed a tour of 10 African countries, made possible through an IDRC fellowship. This commentary is based on a report by him entitled Television for Development: The African Experience, published by IDRC (MR-121e).

providing the means for preserving cultural values.

In fact, there is evidence that the medium has even had a negative influence and has enlarged, rather than diminished, the gap between rich and poor, between urban and rural people. And, instead of nurturing traditional cultural values, it has eroded them by offering large doses of imported programming.

Those who most need information on development, the urban poor and rural populations, are usually not within reach of TV signals, can't afford sets, or don't have electricity. Dr O.A. Fadeyibi, of the University of Lagos' mass communications department, describes television as a reverse Robin Hood. Poor people's taxes are being used to entertain the rich, and governments end up paying large sums of money to send the wrong messages to the wrong people.

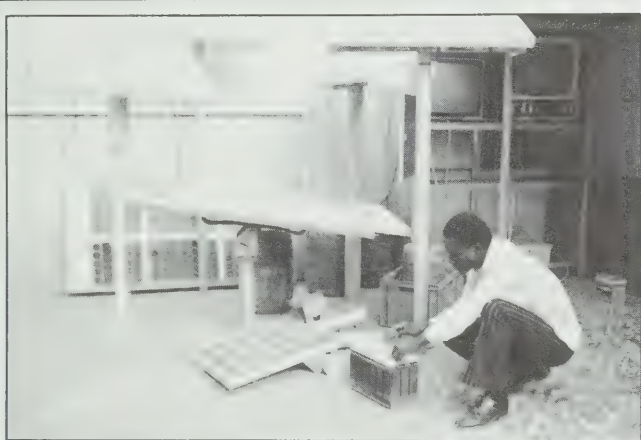
Part of the reason that broadcasting in Africa has been a disappointment is that the analysis of the potential of television was faulty to start with. There has been a tendency to underestimate the social, cultural, economic,

and political restraints that combine to limit its potential.

Political restraints in particular have handicapped TV's development. Few governments have encouraged the kind of freedom of expression in the media that would enable the urban and rural poor to better understand themselves and articulate their needs. In light of the political instability of many African countries, it is not easy for governments to embrace the idea of giving their citizenry the means to explore various development options and express their points of view.

According to University of Dakar communications professor El Hadj Diouf, most African governments fear that once communication channels are opened, they will be used to criticize the authorities, organize resistance, and even overthrow governments. But Diouf argues that there is a much greater risk in keeping the population mute and ignoring their input.

Unfortunately, African governments have chosen to set up TV broadcasting systems in the style of the Western countries that helped es-



In Niamey, Niger, technician Sidlo Salifou of the Société nigérienne de télévision tests solar panels that will power TV sets in remote communities.

mind, I conducted a survey of 10 African countries. Television proved to be in various stages of development. But in each country great dissatisfaction with the way the medium has evolved and is being used was expressed by just about everyone interviewed — producers, government officials, viewers, educators, field workers, and aid donors.

motivating the masses.

Nigeria recently celebrated its 25th anniversary of broadcasting by examining what TV has become and discussing what it might be. The feeling among government officials, broadcasters, and the general public is that it has failed to meet the challenge of accelerating the development process, contributing to the integration of society, and

tablish them. They tend to be cumbersome and heavily centralized, and depend on high-cost production techniques and facilities. In Zaire and Zambia, for example, so much has been spent on establishing a highly centralized and expensive infrastructure that there is little money left to produce the programs needed to modernize attitudes and behaviour.

TV RARELY DEPICTS AFRICA

As a rule, African television rarely shows or explains Africa to Africans. It looks elsewhere. What is often broadcast on African TV is American programs such as "Dallas", "I Love Lucy", "Sanford and Son", or French police films.

On most evenings the African content seen on the majority of African TV stations consists of political speeches, reports on visits of foreign dignitaries, development "experts" speaking over the heads of the average viewer (in European languages), or dramas featuring upper class characters with Western problems.

Despite the costs and handicaps, just about every African government has chosen to develop television. It is a glamorous medium. It brings prestige and provides a means for getting political messages to largely illiterate populations.

A number of those surveyed agree that the only justifiable role for television in low-income countries is that of development instrument. And it can be an effective instrument only if it is integrated and coordinated with other development efforts.

Many people see a variety of possibilities for the future of development-support television: broadcast signals that reach rural as well as urban areas via satellites; government-purchased and maintained TV sets for group viewing, powered by solar energy; coordinated multimedia campaigns and local animation; increased feedback and interaction between broadcaster and viewer; and community broadcasting in local languages.

During a 3-month, 10-country survey of television broadcasting, I saw some en-

couraging signs. Nigeria has plans to restructure completely its 32-station network and change its programming orientation to make it more responsive to development needs and relevant to a larger percentage of the population. The Nigerian Television Authority will be partly decentralized; local stations will be given the resources to produce material for the national network as well as their local programming.

Ivory Coast has started to coordinate nonformal educational TV broadcasts with a network of field animators who are equipped with other forms of development-support communications media. TV sets that were used in the formal education of children are being taken out of the schools and placed in villages around the country.

Niger is proving that a lot can be done with few resources. It operates solar-powered TV sets for group viewing in a number of rural villages and in urban youth

some countries, such as Ivory Coast, where educational programming and field animation have been combined, the urban poor and rural populations have been receptive to information on development.

Those interviewed suggest that, if television is going to

"Television's record as an educator and instrument for effecting changes and progress in Africa is a dismal one."

be used as a tool for development, it will be the combination of newly developed technologies — solar power, satellites, low-cost portable video equipment — and the decentralization of the medium that will make it possible.

Field animation or having

were either educated in the West or use Western programming to inspire their productions. Because the broadcasters are, for the most part, part of the educated urban elite, their programs tend to speak to that sector of society.

Bayo Sanda is general manager of the Nigeria Television Authority's station, in Ibadan, Africa's first station. He agrees that producers should become more aware of development needs but adds that all the blame for television's failure to live up to its promise should not be shouldered by the broadcasters. Sanda says the objectives of television broadcasting have never been clearly defined. "No one advised us to serve an elitist segment of the population. There has been no planned strategy and programming has been uncoordinated with other development efforts."

Before television can be "reinvented" and play a more important role in supporting and promoting development,



In Libore Bangou Banda, Niger, children watch a black-and-white TV powered by a solar battery.

centres. Tele-Sahel's whole program schedule is geared to nonformal education and more video recording is being done on location in rural areas than in the Niamey studios.

Most of the ingredients necessary to "reinvent television" and radically change its present orientation already exist in Africa. Considerable talent has been developed in film and television production; networks of field personnel (agricultural agents, teachers, and health workers) have been established; and in

someone on the spot to explain what is on the screen and answer questions can be the glue needed to make the technology-delivered messages stick.

WESTERN-ORIENTED BROADCASTERS

A major obstacle to re-orienting African television broadcasting toward communications for development is the broadcasters. In the countries surveyed the majority of writers, producers, directors, and journalists

courageous political leaders must want it to do so. It remains to be seen how much political will exists to mold the medium into a force for inspiring change and giving it the freedom to work toward that goal. □



Administering ORT in Bangladesh.

Immunization and ORT lead the way

Vaccines prevented almost one million Third World children from dying in 1985, according to a United Nations Children's Fund (UNICEF) publication, *The State of the World's Children 1986*.

The use of Oral Rehydration Therapy, an inexpensive treatment against the deadly effects of diarrhea, has also made good headway. It is estimated to have saved the lives of 500 000 children last year.

The UNICEF report says that demand for vaccines has tripled since 1983 as many countries accelerate their vaccination programs to meet the UN goal of universal child immunization by 1990. In certain districts of New Delhi and Karnataka in India, for example, child immunization rates have soared from less than 20 percent to more than 80 percent in a little more than a year. And in the 19 state capitals of Nigeria, the results of an immunization campaign indicate that 8 to 10 times more children were being vaccinated per month in 1985 than in the corresponding months of 1984.

In all, some 40 nations with about two-thirds of the developing world's children have speeded up their vaccination efforts. Medical innovations, the training of thousands of immunization teams, and major efforts to reach larger numbers of parents with basic health information are cited as the factors behind the acceleration in Third World immunization.

The UNICEF publication contains a multitude of useful statistics and indicators, as

well as extracts and summaries of recent research and writings on child health and development. For more information, contact UNICEF, Palais des Nations, CH. 1211, Geneva 10, Switzerland.

Technology missions for India

Indian Prime Minister Rajiv Gandhi announced plans last autumn to launch 10 "technology missions" every year in specific areas of applied sciences aimed at making India a leader in these fields.

These missions are to be selected from areas such as family planning, agriculture, energy, and eradication of poverty where expertise already exists.

"I don't think we are doing enough in building excellence in science or improving the quality of our products," Gandhi said. "Our present-day industry is almost totally based on imported or copied technology. We are not even making a good paper clip. Just a tiny fraction of what we produce is based on technology developed within the country."

Gandhi said the government would try to remove some of the problems faced by scientists. Agencies involved in the missions would be given greater freedom and proper funding, and would have to deal with little red tape.

Indian scientists should stop developing substitutes for items that could be imported at a lower price than the cost of developing them in the country. Apart from critical areas such as defence, import substitution should not be resorted to, Gandhi said.

"The concept of import substitution was important 30 years ago, but today the situation has changed."

From the daily newspaper *Indian Express*.

Resisting the mealybug

"The first place in Africa where the cassava mealybug was found was in Zaire, in 1973, and I'm pleased to be able to tell you that it is in Zaire that a variety of cassava has been discovered which is resistant to the mealybug."

This rather triumphant statement comes from researcher Kilambu Ndayi, co-director of PRONAM (the National Cassava Project) in Zaire.

The cassava mealybug (*Phenacoccus manihoti*)

26 days. Larvae and clusters of eggs are transported by the wind and by people when they handle infected plants.

Losses caused by the mealybug can run as high as 60 percent of the roots and 100 percent of the leaves, harming the food supply of the 300 million people worldwide who consume cassava. "When there's a shortage of cassava in Zaire, social stability itself is threatened," an observer in a Kinshasa restaurant was overheard to say.

Combating the pest chemically is not only expensive but also dangerous because it involves a high risk of poisoning those who consume the leaves. Until now the only effective approach has been biological control.



This tiny wasp is a natural enemy of the mealybug.

was accidentally introduced into Africa from South America. It spread so rapidly that it is now found in almost all the coastal regions where cassava is grown, from Senegal to Angola, including the Congo and Cameroon. (See *Reports*, October 1984.) It also affects much of East Africa.

The breeding habits of the insect are one reason it has spread so quickly. Its biological cycle, from egg to adult breeder, is only 24 days. The average fertility of females is 440 eggs which can last for

"Through the International Institute of Tropical Agriculture (IITA) in Nigeria we imported wasps, which prey on the mealybug, and released them in Kinshasa and Bas-Zaire," says R.D. Hennessey, PRONAM's entomologist. "Now there are billions of them attacking mealybugs over almost 40 000 km²."

However, no matter how satisfying the results of the biological control program are, the discovery of a variety that is resistant to the mealybug is still a great victory for PRONAM.

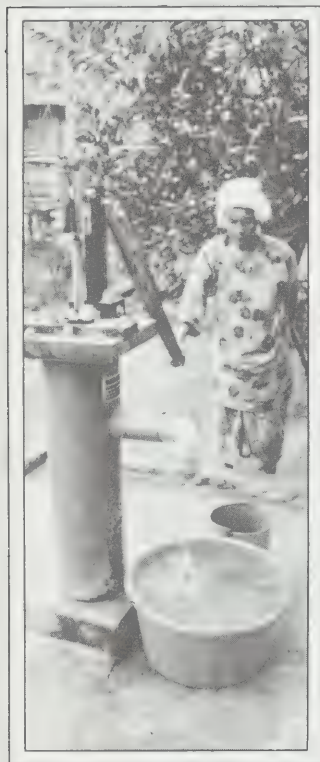
There are still problems with the dissemination of this variety. A staff member of PRONAM admits that it is still very vulnerable to other cassava diseases and that its yield is too low. The PRONAM team is therefore trying to transfer its resistance to 'kinuani', a variety with a good yield which is already being disseminated.

Isaac Njifakvé
Radio Cameroon

Award primes PVC pump

The robust plastic hand-pump developed for rural areas by the University of Malaya in Kuala Lumpur, Malaysia, has been drawing more than water recently.

Last fall the Plastics & Rubber Institute Malaysia presented the University with its



Inaugural Award for Industrial Innovation. The award honours the University for its work in developing the poly-vinyl chloride (PVC) hand-pump, which is now being mass produced in Malaysia.

The pump is based on a prototype designed by Canada's University of Waterloo in 1978. With IDRC funding, a team led by Dr Goh Sing Yau of the University of Malaya's Department of Mechanical Engineering redesigned and perfected the pump so that it could be easily manufactured in their country and operated

and maintained by villagers.

IDRC has supported similar handpump projects in Sri Lanka, the Philippines, Thailand, Ethiopia, and Malawi. (See *Reports*, October 1984, October 1985).

Conferencing in the comfort of home

These days a micro-computer equipped with communications software and a modem is all you need to participate in a variety of computer conferences such as those described on pages 5 and 6 of this issue.

With the aid of ordinary telephone lines, users in more than 70 Canadian cities have access to CoSy (Computer Conferencing System), a network of teleconferences set up by the University of Guelph in Ontario, Canada. The link is made via Telecom Canada's Data-pac service. In the United States and Canada, some 180 computers in 70 universities and research centres gain access to CoSy through the NETNORTH/BITNET network.

There are also CoSy users in another 26 countries, many of them in the Third World. In general, teleconferencing is possible wherever packet switching services are available.

For more information on CoSy, contact the University of Guelph at (519) 824-4120. Dozens of teleconferences are currently in progress, including ones on biotechnology and on the most recent applications of computer techniques.

Fellowships for ocean studies

The International Centre for Ocean Development (ICOD), based in Halifax, Canada, recently launched a new fellowship program for Third World students.

Last November, ICOD announced it had awarded fellowships to 44 students from 17 developing countries for studies in marine sciences, engineering, and social sciences. The students are spread out among 15 universities and scientific institutions across Canada.

Fisheries ecology and biology programs are being fol-

lowed by 15 of the awardees, oceanography and marine geology by 13, engineering by 7, and social sciences by 9. The total value of the 44 fellowships is CAD\$267 000.

ICOD was created in 1983 as a nongovernment organization and then established as a Crown (parastatal) corporation by the Government of Canada in 1985. The Centre's stated mission is "to assist developing coastal countries in the management and development of their fisheries and other ocean resources". It does this by acting as a link between Third World countries and Canadian institutions with the appropriate scientific expertise.

ICOD's planned programs include the provision of technical advice and assistance, training, and the dissemination of information.

For information, write to: ICOD, 5670 Spring Garden Road, 9th floor, Halifax, Nova Scotia, Canada B3J 1H6.

The struggle for literacy

The Canadian Organization for Development through Education (CODE) has won a Unesco prize for its efforts to combat illiteracy in the Third World.

Founded in 1959 under the name Overseas Book Centre, CODE has carried out a major literacy program in cooperation with governmental and nongovernmental groups in more than 80 developing countries. At present it is concentrating its efforts in the Caribbean and East and West Africa. Its activities include the provision of books and teaching materials to rural schools and the financing of adult literacy programs.

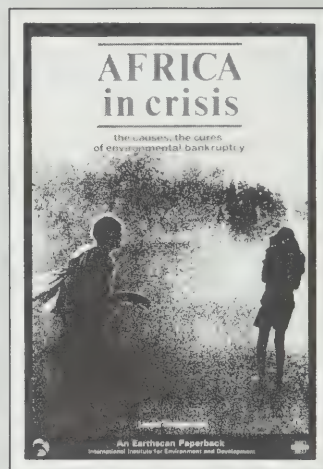
CODE is also collaborating with IDRC on a project to distribute 13 Canadian academic journals to about 100 Third World research institutions.

Famine and the environment

After watching all the images and listening to the words describing the tragic famine in Africa, many are asking themselves why this is happening. In *Africa in Crisis*, British journalist Lloyd Timberlake provides an explanation: famines in Africa are

caused by the deterioration of the environment.

In a clear and convincing manner, he explains how big and inappropriate projects, demography, overexploitation of the soil, bad policies, and unjust land tenure regulations combine to destroy the capacity of the land to nourish its occupants.



Timberlake not only has produced a captivating report about Africa, but he authoritatively demonstrates the importance of taking care of the environment. He applies his analytical model to South Africa, showing that environmental bankruptcy alone will bring about the downfall of apartheid.

Africa in Crisis is published jointly by Harmattan publishers and Earthscan where Lloyd Timberlake is director of publications.

Regional Postgraduate
Program in Information
Science in Anglophone Africa
Identification of an Appropriate Location

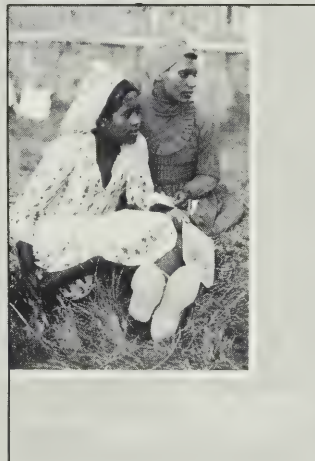
IDRC-TS

Regional Postgraduate Program in Information Sciences in Anglophone Africa. *Editor: Kenneth H. Roberts. Published February 1986, IDRC-TS53e, 68 pages.*

African countries in which English is the language of higher education maintain several excellent schools of library science and high-level programs in computer science; however, no academic program in information science has been fully developed. In response to requests from Africa, and as a first step in establishing such a program, the United Nations Educational, Scientific and Cultural Organization (Unesco) and IDRC sent a joint mission to eight African universities in six countries to determine their views of the needs in information science, the types of programs required to meet those needs, and the capacity of these institutions to undertake such a program, and to recommend to Unesco and IDRC which institution should be encouraged to set up a regional postgraduate program in information sciences. This report presents the results of the mission and outlines the methodology used in its planning and execution; it will be useful to those working toward setting up similar programs in other parts of the developing world, or teaching information science to students from developing countries.

Sugar: Threat or Challenge? An Assessment of the Impact of Technological Developments in the High-Fructose Corn Syrup and Sucrochemicals Industries. *Clive Y. Thomas. Published February 1986, IDRC-244e, 140 pages.*

This study assesses the "threat" to the traditional role of sucrose as the leading sweetener brought about by several technological innovations and the "challenges" afforded by similar innovations in sucrochemistry. The major threat derives from two sources: the commercialization of high-fructose syrup made from corn, and its possible extension to other carbohydrate sources; and the development of a new generation of noncaloric sweeteners, principally Aspartame. The "challenges" derive from efforts to replace petroleum (a "finite" resource) as the world's principal chemical feedstock with sucrose (a "replenishable" resource). This has led to a new field of science, "sucrochemistry", whose essence is to treat sucrose not as a sweetener but as a chemical product that can be transformed into other chemicals of greater worth. The promise of a radical departure from the traditional sequences of industrialization of tropical staples exists, and its implications for developing areas and the Caribbean are drawn.



Searching: IDRC 1985 (Research: A Path to Development). *The IDRC annual review, published January 1986, IDRC-245e, 52 pages.*

This edition of *Searching* examines the growth and current role of multilateral research institutions in the developing countries. It also describes the activities of IDRC's various divisions during 1985. The publication is also available in French (*Quête d'avenir*) and Spanish (*Búsqueda*).

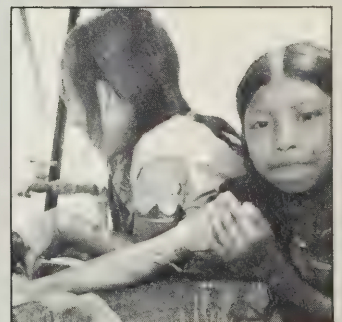


Photo: Steven Hunt

Back cover: Guatemalan children benefit from a scheme to pipe fresh mountain water to their village. Drinking water technology is the sub-theme of this issue of *Reports*. See photo feature and articles, pages 14-21.



In addition to IDRC *Reports*, the Centre publishes a wide range of material on development issues. These include scientific monographs, reports, and bibliographies on specific IDRC research areas, as well as general interest literature. These publications represent research interests and activities supported by IDRC in agriculture, food and nutrition, population, health, education, information, and social sciences. Films describing the Centre and some of the areas of development research are also available. A catalogue of current material, publications or films, is available from the nearest IDRC regional office or from IDRC in Ottawa (see page 3 for complete addresses.)

Publications may be ordered from the IDRC sales agents listed here.

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VOLUME 15, NUMBER 3 — JULY, 1986

Reports

THE
IDRC



Health, hygiene, and the community

A simple way to shell peanuts

Agrogeology in Tanzania



CANADA

Fluorosis in Africa

I read with interest the letter on the subject of fluorosis, published in *The IDRC Reports* (Vol. 15, No. 1 — January 1986). In view of information received that dental caries are suspected among some primary school children, we are carrying out a chemical survey of the Cape Coast area and we shall be very grateful if you send us a copy of 'Fluorosis in Africa', published in *Reports* (April 1984).

Dr Mahmood A. Khwaja
Department of Chemistry
Cape Coast University
Ghana

The potential of mycorrhizae

The article on mycorrhizae which appeared in the January 1986 issue is, so far as I know, the first you have ever published on this universal symbiosis. Your article will help those who work both in agriculture and in forestry to focus special attention on this area.

In the near future large-scale applications will become possible with certain crops (e.g., market vegetables, fruit, tree species). The intensive use of endomycorrhizal fungi will require a rationalization of the use of phosphate fertilizers in particular, thus leading to a drop in expenditures for such fertilizer.

It should also be pointed out that the introduction of mycorrhizal fungi into the soil does not need to be repeated for each crop (annuals). Efficient mycorrhizal strains can survive in the soil for several years, provided the

application of phosphate fertilizers and of certain biocides (especially fungicides) is strictly controlled. Crop rotation must also be carefully considered as certain species of cultivated plants do not form mycorrhizal associations.

Dr Valentin Furlan
Biologist
Agriculture Canada
Sainte-Foy
Quebec, Canada

Paulownia in pulp and paper industry

The article entitled "China's wonder tree" by Chin Saik Yoon and Gerald Toomey (April 1986) was of great interest to me. I think there is a possibility that Paulownia could even become an important resource in Canada.

We at the Pulp and Paper Research Centre are always looking for fast-growing species for pulp and paper production. In light of the decline of conifers in Canada, the need for new species is all the more evident. Research efforts focusing on the use of Paulownia would no doubt be of use to both the Canadian and Chinese paper industries.

With a view to resolving the natural resources problem for both China and Canada, we are looking to participate in international cooperative research. I would appreciate your passing on this request to the appropriate authority within IDRC.

Dr Ken Law
Pulp and Paper
Research Centre
University of Quebec
at Trois-Rivières
Trois-Rivières, Canada

Editor's notebook

The editorial staff welcomes Robert Charbonneau to the magazine. Mr Charbonneau, the new associate editor responsible for the French edition, *Le CRDI Explore*, was formerly an interpretive writer and media relations officer in IDRC's Communications Division. The editorial team also wishes good luck and success to the former associate editor, Jacques Dupont, who has left IDRC to pursue a career in the arts.

A 'wonder tree' for Haiti?

The article on Paulownia, "China's wonder tree", in the April 1986 issue indicates great possibilities for developing countries. Can you please send us information on the availability of seed and planting technique.

In Haiti we are planting *Leucaena*, *Neem*, *Eucalyptus* and *Casaurina* Pine and feel Paulownia could be a great asset to the economy of the nation.

Kenneth G. Davis
President, Canadian Foundation
for World Development
Willowdale, Canada

For further information, contact:

Zhu Zhao-hua
IDRC Projects Coordinator
Research Institute of Forestry
Chinese Academy of Forestry
Wan Shou Shan
Beijing
People's Republic of China

The Editors

Alley cropping for Mexico

I read an interesting article on alley cropping research in Vol. 14, No. 1. I am a Master's student in renewable natural resources at the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), in Costa Rica, and am currently working on a similar project using *Erythrina poeppigiana* and maize. I hope to complete my thesis and return to Mexico where I was born.

These technologies could be profitably applied in the tropical regions of Mexico where water resources are scarce and soil quality is

poor, causing problems for small farmers.

Sergio Alavez
Turrialba, Costa Rica

For more information on alley cropping, contact:

International Institute of
Tropical Agriculture (IITA)
PMB 5320
Ibadan, Nigeria

The Editors

PVC pump

I have read with interest the article on the PVC pump by Don Sharp in the October 1985 issue of *The IDRC Reports*. I would be grateful for more information on the design, the dimensions, and materials the pump is made of, and would like to obtain the design drawings if possible. Given such information I shall pursue the possibilities of its local production in Sudan (my home country) where it is badly needed.

I find *Reports* inspiring and refreshing, particularly in the area of rural development. I look forward to any information that will further the above objective.

Prof. M.Y. Sukkar
College of Medicine and
Allied Sciences
King Abdulaziz University
Jeddah, Saudi Arabia

Further information on the Malaysian version of the PVC pump may be obtained from:

Prof. Goh Sing Yau
Head, Department of Mechanical
Engineering
University of Malaya
Kuala Lumpur, Malaysia

The Editors

Reports

THE IDRC

Front Cover: In Bangladesh, these children have learned the importance of the link between hygiene and health. See pages 4–9 for health-related articles, three of which examine the role of the community.

Photo: Claude Dupuis.



CONTENTS

Letters	2		
The fragmented pyramid	In a Honduran shantytown, people aren't taking advantage of community health services. Steven Hunt explains why.	4	
Forgotten affliction	A child's common cold can lead to acute respiratory infection. A report on work in India by Carole Graveline.	6	
A motherhood issue	Egyptian women play a part in solving water supply and sanitation problems. By Jean-Marc Fleury.	7	
The fight against schistosomiasis	John Mkamwa and Gerry Toomey report on two efforts to control this debilitating disease in Africa.	8	
A window on Caribbean women	Results of a major study on women will soon be available from an innovative information system in the Caribbean. By Frank A. Campbell.	10	
Shelling peanuts the easy way	Thai farmers are switching from cassava to peanut production. Denis Marchand reports on a promising new device to help increase their incomes.	11	
Rocks in the service of soil	Tanzanian and Canadian geologists aren't joking when they say that farmers should add rocks to their fields. Gerry Toomey reports.	12	
White giants of the Himalayas	Probing the secrets of Pakistan's glaciers will help scientists predict the flow of meltwaters into the Indus River. A photo feature by Fes De Scally.	14	
Faba beans, chickpeas, and lentils	Legumes, sometimes called the poor man's meat, now are getting the attention they deserve in the Middle East and North Africa. By Lynn Teo Simarski.	16	
Persisting against the odds	Jean Lash looks at the challenge of building a new educational system in Kampuchea.	18	
With our own hands	A review of a new IDRC book on the impact of research financed and nurtured by the Centre over the past 15 years.	20	
The one-child solution	China's birthrate has dropped dramatically in the past two decades and now matches that of the industrialized nations. By Carol Vlassoff.	22	
Commentary	Marlene Brant Castellano explains 'participatory research' and how it has been used by Native people in Canada.	24	
Briefs	News and trends in international development.	26	
New releases	IDRC films and publications.	27	

IDRC

The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in five sectors: agriculture, food, and nutrition sciences; health sciences; information sciences; social sciences; and communications. IDRC is financed solely by the Parliament of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are located at 60 Queen Street, Ottawa, Canada (P.O. Box 8500, Ottawa, Canada K1G 3H9). Regional offices are located in East Africa (P.O. Box 62084, Nairobi, Kenya); West Africa (B.P. 11007, C.D. Annexe, Dakar, Sénégal); Asia (Tanglin P.O. Box 101, Singapore 9124, Republic of Singapore); South Asia (11 Jorbagh, New Delhi 110003, India); Latin America (Apartado Aéreo 53016, Bogotá D.E., Colombia); and the Middle East (P.O. Box 14, Orman, Giza, Cairo, Egypt).

The IDRC Reports

The IDRC Reports and its companion editions in French and Spanish — *Le CRDI Explore* and *El CIID Informa* — are published quarterly by the International Development Research Centre. Their aim is to keep readers informed of the activities of IDRC and to present articles on subjects related to the Centre's fields of interest. An Arabic version *بحوث التنمية* is published annually. Copies are available on request from the Communications Division, IDRC. *Editor-in-Chief:* Jean-Marc Fleury. *Associate Editors:* Gerry Toomey (English edition), Robert Charbonneau (French edition). *Spanish edition:* Stella de Feferbaum.

Unless otherwise stated, all articles may be freely reproduced or quoted, providing a suitable credit is given. The views expressed in signed articles are those of the authors and do not necessarily reflect the views of IDRC.

Unsolicited manuscripts and other editorial materials are welcomed and will be considered for publication.

All photos by Neill McKee unless otherwise indicated.



Las Crucitas: Bringing health to the 150 000 poor people of this shantytown is as much a problem of communication as one of doctors or medicine.

THE FRAGMENTED PYRAMID

PRIMARY HEALTH CARE IN A HONDURAN SHANTYTOWN

By STEVEN HUNT

Dolores Ardón picks up the youngest of her four children and carries him in her arms out the front door of her house.

"I had to use a midwife for my 3-year-old here," says the 37-year-old Ardón. "I had a lot of problems with this child. I spent three days in pain before he was born. I'd rather have gone to the social security hospital but it was an emergency. I had no choice."

Dolores' oldest child, her 12-year-old bare-chested son, leans against the doorframe of the small three-room, dirt-floor house watching his mother. The playful screams of her two other children echo from the back of the house where she cooks over a wood stove for her husband.

"You can't see it from here but it's down through the valley," says Dolores, pointing in the direction of the hospital in Tegucigalpa, the capital of Honduras. In front of her is Las Crucitas, a sprawling squatter settlement of poorly constructed homes with tin roofs that hangs on the steep hills surround-

ing the capital city of half a million. Almost 50 percent of Tegucigalpa's 320 000 poor people live in Las Crucitas, most without running water or adequate sanitation.

"I prefer the hospital for most important problems," says Dolores. "If one of the chil-

The study provided a picture of a fragmented health community in Las Crucitas.

dren has diarrhea for more than a couple of days I'll take him to the hospital. I can get medicine there for maybe 50 centavos, sometimes I can get it for free."

Dolores and many others in her community prefer the hospital over local community clinics or the services of government-trained community midwives. A study by the Cen-

tro de Estudios y Promoción del Desarrollo (CEPROD) (Centre for the Study and Promotion of Development) found less than 12 percent of women use midwives and then, usually only in an emergency. Hospitals, therefore, are overcrowded. For example, one hospital had well over 14 000 deliveries in 1984 but it was designed for only 7000 births annually. This has increased risks for newborns by reducing the amount of time for post-delivery care.

"When the Ministry of Health introduced their health system for the marginal areas they didn't know community needs," says Dr Guillermo Molina of CEPROD. "The Ministry just extended the rural model to the urban areas. That's why many of the women don't use the services."

Health coverage was extended in 1982 to the marginal urban population that lives around Tegucigalpa and San Pedro Sula in accordance with the United Nations' call for "Health for All by the Year 2000". It was an extension of the government's 1973 goals

to expand basic health care to the rural areas where 60 percent of the country's population lives.

Some of the worst conditions in Latin America exist in these outlying areas. Much of the population is underfed with 80 percent of children suffering some form of malnutrition. For the past 15 years, malnutrition and diarrhea have been the primary causes of death in children under 5. Infant mortality runs between 87 and 117 per 1000 live births, compared to an average of about 12 in most industrialized countries, and life expectancy for 1980 was estimated to be 58.8 years.

In the marginal urban areas, the structure of the health system is similar to that of the rural regions in that each level of the system is meant to screen increasingly complex cases.

COMMUNITY GROUPS NOT ACTIVE

The study provided a picture of a fragmented health community in Las Crucitas. "We found the CESAMO wouldn't always take a referral from the CESAR," says Dr Molina. And the community organizations were not active in health care and had little contact with health professionals. Only in national vaccination campaigns were community organizations involved. Community efforts were directed towards other basic services such as water supply and the problems of sanitation that plague Las Crucitas. Maternal and child care was not an issue. Often the community leader did not know the community midwife.

The health volunteers were very young, without community experience, and usually

the study preferred to use a health centre staffed by a doctor, or else the hospital. Less than 12 percent of the women had attended preventive health programs, less than 50 percent had heard of the midwife in their area, and less than 10 percent had heard of the health volunteer.

Women in the marginal urban areas lacked information about the correct use of oral rehydration therapy (for children with diarrhea) and other drugs such as antibiotics. Nor did they understand the importance of family planning and prenatal and postpartum care.

HOUSEWIVES' CLUB

On a Friday afternoon, the Centro del Patronato del Flor is loud with women's laughter. It's a break for the members of the



Members of the Housewives' Club with their children. Once a week the women get together here to learn about hygiene.

The lowest level of the health pyramid consists of community clinics called CESARs. Each is attended by an auxiliary nurse. At the intermediate level, CESAMO clinics are attended by physicians. The 13 general and 6 specialty hospitals of Honduras are the highest level of the health structure.

"This type of approach has proven successful in the rural areas where there are no hospitals. But the Ministry of Health has not been very successful in reaching many of the people in the marginal urban areas," says Dr Molina. "People still prefer going to the clinic with a doctor, to a hospital, or are completely unaware of midwives and health volunteers because the Ministry of Health never consulted the communities. It did not employ workers well trained in community development and there was very little coordination between different levels of the health pyramid."

Between October 1983 and September 1984, CEPROD, an independent agency with funding from IDRC, studied maternal and child health in seven marginal areas of Las Crucitas. Five hundred women with children under the age of 14 were surveyed, along with 16 health volunteers, 12 midwives, 36 community leaders, and 57 health professionals.

selected by a social worker outside the community rather than by the community itself. The volunteers did not participate as health workers in community organizations nor were they supervised in the field after they were trained.

The midwives on the other hand were middle-aged or elderly, with much experience. But they were used only in emergencies which meant that they had not been

Many women in the study, not belonging to any community association, were not aware of some of the services available to them.

involved in the prenatal care of mothers they attended.

Many women in the study, not belonging to any community association, were not aware of some of the services available to them, distrusted some community services, and were not involved in preventive programs. Almost 50 percent of the women in

Club de Amas de Casas — the housewives' club. Social workers have been showing them basic hygiene as part of a weekly course.

"There should be greater emphasis on courses like this," says Dr Molina. "They provide a way for women to learn about primary health care. But more importantly it brings women into the community organizations."

The community, he says, must be an integral part of the health care system and involve itself in the promotion of its services. Las Crucitas has community health workers, midwives, and some clinics, but unless women are aware of the services available, they will always prefer to go to the hospitals.

The problems of such a community must be dealt with in a multidisciplinary fashion, says Dr Molina. "We think health can't be improved without better water supply, trash collection, and education. But to be able to do this the whole community must be involved. Without it, it will not work." □

Steven Hunt is an independent writer/broadcaster based in Ottawa.

FORGOTTEN AFFLICTION

ACUTE RESPIRATORY DISEASES IN INDIA

By CAROLE GRAVELINE

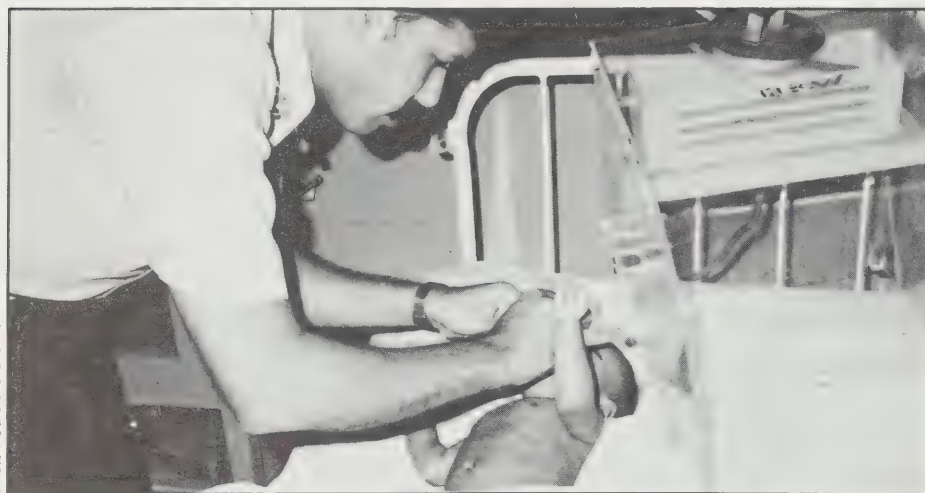


Photo: Carole Graveline

In several Third World countries, acute respiratory infections rank second as a cause of infant death.

In developed countries, the common cold is no more than a passing inconvenience, trivial for most and rarely of any serious consequence to one's health. Such is not the case elsewhere in the world. There, a mere cold can and often does lead to tragic results. This is especially true in India, where 40 percent of infant illnesses are caused by acute respiratory infections (ARI), which can undermine a child's overall resistance, if not actually shorten his or her life expectancy.

Slightly more than three children out of every 1000 die each year in India from complications associated with ARI. This is the same rate that existed in Canada 60 years ago. Like Canadian children, children in India suffer from some type of respiratory infection four to seven times a year. The only difference is that some of these Indian children will die from their illness.

ARI is the second most important cause of infant mortality in several developing countries, the first being diarrheal diseases. In India, ARI accounts for 30 percent of all deaths before the age of 5. Unlike gastro-intestinal diseases, however, researchers until now have paid little attention to illnesses associated with respiratory infections.

Believing the time had come to deal with this 'forgotten affliction', IDRC undertook initiatives with various bodies, including the World Health Organization, to fund a number of research teams, in particular those working in India and Egypt. One such team, headed by Dr Jacob John, at the Christian Medical College virology laboratory in Vellore in southern India, has been waging a fierce and tireless battle to determine the source of these infections and how they spread. The researchers hope to develop effective prevention and treatment techniques.

How does one account for the seriousness of respiratory infections in children? At this

stage in the research, the answers are not clear. What is certain is that the lack of health care services — most cases go undiagnosed and untreated — and the country's widespread poverty are two very important factors.

Data show the incidence of ARI to be highest among India's poor. Weakened by chronic malnutrition, children living in poor areas have a difficult time overcoming infection and disease. Their resistance to infection is often undermined further by parasites. Promiscuity and the lack of adequate sanitary facilities in these areas only compound the problem.

Weakened by chronic malnutrition, children living in poor areas have a difficult time overcoming infection and disease.

Between 30 and 35 children arrive at the Christian Medical College Hospital in Vellore each day with symptoms of respiratory infection. Those younger than 5 with typical ARI symptoms — namely, running nose, earache, and difficult or rapid breathing — are kept at the hospital for up to five days for observation and analysis. Specimens of nose and mouth secretions, and occasionally of lung tissue, are taken to determine whether the infection is caused by bacteria or a virus.

KNOW YOUR ENVIRONMENT

The parents are also asked to help by completing a questionnaire that will enable

Dr John's team to identify the social, economic, and environmental conditions that can increase the child's risk of infection. "The presence of smoke in the home, either from cooking or tobacco, is as important a factor as the parents' ability to feed their family," Dr. John points out. "None of these factors can be overlooked. It is also important to find out who in the family makes the decisions since this person will be the basis for developing the tools used for early detection of respiratory infections."

Dr John knows from experience that for any medical approach to be effective, it must take into account the particular local context. Sophisticated screening methods are useless if, for example, a patient does not seek medical help because of his religious beliefs. To prove his point, Dr John relates an anecdote from his early days as a pediatrician in India:

"I noticed that I was seeing only minor cases of diarrhea. The more serious cases didn't show up at the hospital because the parents thought it best to take their ailing children to the temple instead. Now I defy anyone to find this distinction between 'minor diarrhea' and 'divine diarrhea' in any medical book. Yet this is precisely what we have to know before we can develop an effective policy for eradicating disease."

Thanks to the research now going on, Dr John plans to lay the groundwork for national health policies that are suited to the needs of the Indian population. The welfare of future generations depends on it. □

Carole Graveline, a Canadian journalist, visited this IDRC project as part of an initiative of the Fédération professionnelle des journalistes du Québec, funded by the Canadian International Development Agency.

EGYPT'S NUMBER 2 CHILD KILLER

Acute respiratory infections rank second among the causes of infant mortality in Egypt. They are caused by a variety of viruses, bacteria, and fungi that make their way into the child's lower respiratory tract.

A research project has just begun in this country, bringing together teams from the faculties of medicine of McMaster University in Canada and the University of Alexandria in Egypt. Their aim is to identify the specific pathogens present in the lower respiratory tract.

Researchers will look at the role played by a pathogen called chlamydia in acute respiratory infections, something which up until now has never been studied in any detail. Responsible for trachoma, a chronic and contagious form of conjunctivitis, chlamydia is prevalent in rural areas of Egypt where the majority of people are vulnerable to it.

A new chapter in the long history of the Egyptians and their water is being written. This one is not about engineers and millions of tonnes of concrete, but about villagers, water taps, and latrines.

For centuries, indeed for thousands of years, Egyptian women washed utensils and clothes in the Nile River and in irrigation canals. Almost everybody drank from these sources despite the ever larger amount of refuse being thrown into them. Then in the second half of this century, water mains and public taps appeared in thousands of villages.

Nowadays many of the water sources don't work. The women still wash utensils and clothes in the canals. "In one village, where every house has a water faucet," says Sahima el-Katsha, a senior research assistant at the American University in Cairo (AUC), "all the women keep going to the canal." And every time they come into contact with canal water, they run the risk of getting and spreading Bilharzia, a parasitic disease caused by a tiny worm which penetrates the skin and invades blood vessels.

A number of factors, including poor sanitary habits, increase the risk of spreading the infection. Dirty household water is disposed of in the streets and many people don't understand the need to wash their hands. The lack of latrines, or the presence of ones that don't work properly, makes matters even worse. In effect, mothers unwittingly become the agents of contamination in their own households, with the result that of every 1000 babies born, 80 do not survive their first year of life. Water-borne diseases, including diarrhea, are the main cause of death.

"That does not mean the mothers don't love their children," says Mrs el-Katsha. "They also take great pride in their homes, but they do not connect hygiene with disease and they feel no responsibility for what goes on outside their homes." The broken-down water taps, the puddles of stagnant water around the ones that work, and the heaps of garbage are proof that no one feels any responsibility.

BREAKING THE CYCLE

The women spend from four to eight hours a day carrying or using water. Many hygienists are now trying to get their cooperation in breaking the cycle of contamination. AUC's Social Research Centre has already taken on a number of investigations — with support from the Ford Foundation in the United States among others — into the part women could play in improving sanitary conditions in Egypt.

"Now that all the other methods have failed," says el-Katsha, "isn't it about time to think of women?"

Redefining the role of women in sanitation is exactly what is involved in a two-year study directed by el-Katsha which IDRC recently agreed to fund. In this research, the AUC team will try to find out why women continue to go to the canal, even though their house has a water faucet.

In some villages, the explanation could be technical. "Faucets bring water into the house, but there isn't a drain," says el-Katsha. "Women, therefore, prefer to do their washing in the canal. Otherwise they

A MOTHERHOOD ISSUE

By JEAN-MARC FLEURY



Household sanitation and family health depend largely on women, the traditional bearers of water.

wouldn't know how to get rid of the wash water." In other villages the children defecate anywhere they wish because the openings in the tops of the latrines are too large for them.

PLASTIC PIPES AND HANDPUMPS

There are answers to these problems. The inhabitants of the village of Demiatta, for example, took it upon themselves to install plastic piping and handpumps to transfer used water from their houses to the drain. The AUC specialists want the villagers to come

up with the solutions systematically and they are insisting that the village women be closely involved in their implementation.

Over the next two years, Samiha el-Katsha's associates are going to get to know a lot more about dozens of homes in two villages in the Nile Delta. Then they will train communicators who will mobilize the entire community, especially the women, to think about how to supply themselves with drinking water and get rid of used water. The solutions are bound to be simple and realistic, because they will come from people who, in one way or another, are in contact with water for much of their day, every day. □

A KENYAN COMMUNITY FIGHTS SCHISTOSOMIASIS

By GERALD TOOMEY

Heels are dug into the red Kenyan soil. Hands are gripped firmly around supporting ropes, now as taut as piano wires. In the heat of the equatorial sun, 25 village men strain and sweat under the load of a 750-kg concrete well tile that is precariously perched on the edge of a deep hole.

"Wacha. Pole! Pole! (Release. Slowly! Slowly!)" a Ministry of Health worker yells in Kiswahili, as he forcefully guides the tile into place. After a few tense moments, the massive concrete cylinder slides down the well to its final resting place with an undramatic thud.

Another blow has been struck against schistosomiasis, a water-borne parasitic disease difficult not only to pronounce but, more disturbingly, to control. About 70 percent of the residents of this Kenyan community, called Thiba, are afflicted with it. In Kenya, recent estimates indicate that nearly 2 million people — over 10 percent of the population — are infected.

The afternoon's work has been one small step in the installation of a public well. The well, in turn, is just one component of a three-year IDRC-supported research project designed to determine the effectiveness of community participation in halting the transmission of schistosomiasis.

Thiba, which is actually a cluster of three villages, is a rice-growing Kikuyu community of 2000 people, located about 100 km northeast of Nairobi. It is part of the 40-village Mwea-Tebere Irrigation Scheme run by the Kenyan government.

In the 1950s, the colonial government set up internment camps in this area to house captured Mau Mau freedom fighters who were then forced to grow rice. After independence in 1963, the government resettled many landless peasants there and took over the irrigation scheme. Today, former Mau Mau freedom fighters and their children still work the rice fields, side by side with other resettled people.

But the introduction of irrigation canals provided a perfect breeding ground for the freshwater snails that spread schistosomiasis. Infection rates shot up. In the case of intestinal schistosomiasis, the highest infection rate in the Mwea Irrigation Scheme is among children in the 5–19 age group.

"It's a hot area," explains Melanie Katsivo, a medical sociologist with the Kenya Medical Research Institute and leader of the research project. "Children like to swim, especially in the heat of the day when the snails release their cercariae (infective worm organisms)."

The community's main source of drinking water is a stream connected with the rice irrigation system. Infected villagers often defecate along the shores and thus infect the water and the snails it harbours. Simple contact with the water is enough to transmit the disease and therefore even daily crossing of the stream by barefoot children on their way to school is a serious health hazard.

Controlling schistosomiasis in Africa by killing the intermediate host snails with chemical molluscicides has proven to be too costly for most governments. The use of mass drug treatment programs to cure infected people is also expensive, and, by itself, not very effective in the long run because it is so easy for people to become reinfected.

Katsivo's project, conducted in cooperation with the villagers and various government bodies, takes a different approach to breaking the cycle of infection. The research team has attempted to involve the community in improving village sanitation as well as in health education. "The purpose of the intervention — the bath houses, wells, bridge over the stream, and so on — is to remove people from their old water sources, and therefore cut down the risk of infection and reinfection," explains Katsivo.

The first stage of the project was to collect baseline data on the two communities in the study, namely Thiba, the experimental village, and Mahigaini, the "control" vil-

lage. (Mahigaini is close to Thiba and of similar size and social makeup.) The baseline data included information such as the numbers and ages of the men, women, and children in the communities, and rates of infection.

The second stage of the research, the intervention, is the heart of the project and is nearing completion. So far, it has been enormously successful. Despite their low incomes, the villagers raised enough money among themselves to fund the construction work. In the case of the wells, the Ministry of Works constructed the tiles, while the villagers paid for the materials and provided the labour for installation. "The fact that the villagers are working on weekends, giving up their free time, indicates that they are motivated," says Katsivo. "And without motivation, we

6. Microscopic cercariae penetrate skin to infect humans.

are wasting our time."

Another element of the intervention is an ongoing village education program. Mothers are taught, for example, the importance of fetching water early in the morning or late at night when the risk of infection from the microscopic cercariae is lessened. (Wells will eventually eliminate the need to fetch water from the river.)

After one year, 200 heads of households were surveyed to find out what they had learned about schistosomiasis. The general result was that people had learned two or more methods of avoiding infection. Once

5. Sporocysts transform into cercariae which snail releases.



Pulling together to fight waterborne diseases: Villagers at Thiba install a community well.

the community construction projects are completed, the research team will arrange for everyone in both the experimental and control villages to be given drug therapy to bring the infection rates to zero. By comparing the subsequent reinfection rate in Thiba to that in Mahigaini (where the only intervention was the drug therapy), Katsivo and her team will be able to determine just how effective their work with the community has been.

If the two villages show a difference, attempts will be made to convince the government to adopt the strategy of long-term prevention rather than short-term cure.

So far, it appears that those families who are taking precautionary measures and using the new sanitary facilities have been successful in avoiding infection. And among rice field workers, the infection rate has dropped. In Thiba, and in other Kenyan villages, there is indeed cause for optimism. □

By JOHN MKAMWA



The sight of large numbers of dead snails just downstream from where local women in northern Ethiopia were washing their clothes forced the young biologist to pause for a closer look. Aklilu Lemma did not know that he was about to make a discovery that would be the subject of extensive research for two decades.

It turned out that, instead of washing with ordinary laundry soap, the women were using a plant known in Ethiopia as "endod" or soapberry (*Phytolacca dodecandra*). The plant and its berries have been used as soap for centuries in Ethiopia because of their strong bleaching effect.

Dr Lemma, a biomedical scientist and parasitologist, at that time with Addis Ababa University, was doing an ecological study to determine the distribution of disease-carrying snails in water. He took another look at the dead snails and the endod and decided immediately the link between them was

disease and 500 to 600 million more are at risk.

Although community sanitation projects and educational programs are now being used to fight the spread of schistosomiasis, one of the most important control methods so far has been to destroy the intermediate snail host. And the most efficient way of doing this has been the application of molluscicides.

Bayluscide (Niclosamide) is currently the only chemical molluscicide commercially available and is recommended by WHO for wide use. However, very few Third World coun-

tries can afford to import it because of a shortage of foreign exchange. In 1980, a tonne of Bayluscide cost more than US \$25 000.

This has caused near or complete abandonment of schistosomiasis control programs in many countries.

In early 1983, WHO's Special Programme in Tropical Disease Research convened a meeting to evaluate the situation and consider the feasibility of developing plant molluscicide products. It was concluded that endod was the most promising as a safe and regionally available molluscicide-producing plant.

Ethiopia has two main varieties of endod: "arabe" with pink and "ahiyo" with gray berries. The plant is a climber with hanging branches and grows rapidly, usually reaching 2 to 3 m in height.

When soaked in water and left in a warm

place, endod berries ferment rapidly and the mixture eventually separates into a clear fluid which contains the active molluscicidal agent and a residue, mainly yeast cells and debris.

The clear fluid is evaporated in a simple solar dryer, leaving behind endod crystals. These are ground into fine powder which can then be dusted directly over infected water or prepared into different formulations that either sink or float on the water to attack snails.

Research is being conducted inside and outside Ethiopia to provide more information on the toxicity, chemistry, extraction, and application of the endod molluscicide.

In Canada, Dr Legesse Wolde-Yohannes, an Ethiopian biologist from Addis Ababa University, is working with Dr John Lambert of Carleton University, Ottawa, on the chemical makeup of endod and its efficacy as a molluscicide. This and other research may finally make it possible to get WHO's approval for endod to be used officially as a molluscicide. The agency wants to be absolutely sure that the plant is not harmful to people. (Tests have proved that endod, just like other molluscicides, kills fish as well as water snails.)

Aklilu Lemma, discoverer of endod's molluscicidal chemistry in 1964, is now with the United Nations Centre for Science and Technology for Development. He still feels his discovery holds great promise for Africa's fight against schistosomiasis. "The roots and berries are known to be taken by mouth for various medicinal purposes in Ethiopia and Africa in general. If it were harmful it wouldn't have been used for centuries," he concludes. □

John Mkamwa is a Tanzanian graduate student at the Carleton University School of Journalism, in Ottawa.

what he had been looking for.

Subsequent studies of endod, a plant found in many African countries, revealed its molluscicidal (snail-killing) property and suggested it could be used to control one of the most widespread environmental diseases in Africa — schistosomiasis (also called bilharziasis). The disease is caused by a tiny parasitic flatworm which lives part of its life-cycle in freshwater snails and the other part in people. (See diagram.)

Schistosomiasis has a long history in poor Third World countries but research has indicated that the disease is now more widespread than previously thought. The World Health Organization (WHO) estimates that 200 million people worldwide have the



Schistosome worms mature in veins of bowel or bladder, reaching 1 to 2 cm in length. Main symptoms: fatigue, fever, diarrhea, blood in urine, painful urination, abdominal pain. Damage to liver and spleen is cumulative, caused by eggs rather than worms themselves.

A WINDOW ON CARIBBEAN WOMEN

By FRANK A. CAMPBELL



The pool of information on Caribbean women is growing. It is a critical tool in the reform of policies affecting women such as this elderly resident of Saint Vincent.

When the Decade for Women began in 1975, many Commonwealth Caribbean planners and policy-makers argued, according to sociologist Joycelin Massiah, that "women in the region had no problems and required no particular development." In any case, little data existed on which to base special women's programs.

But by the end of the decade the pool of such data had grown considerably, due in large part to the Women in the Caribbean Project (WICP) funded by a group of American aid agencies. WICP, using a multidimensional approach, examined the role and status of women in the labour force, in education, and in family relationships.

Over 1600 women from Barbados, Antigua, and St Vincent were interviewed and 38 chosen for more detailed "life history" interviews. In a third round, researchers focused on specific issues such as the role and attitudes of women farmers, male attitudes toward women, and women's dependence on friends and kinship networks.

Although the interview data have not yet been fully analyzed, much has already been learned about Caribbean women and the problems that women's groups and policymakers must face in attempting to integrate women into the development process. For instance, there is a major contradiction between women's apparent power in the household and actual female experience. Although nearly half of Caribbean households are headed by women, the suggestion that Caribbean women are more independent than other women is partly chimerical, says Dr Massiah, deputy director of the University of West Indies Institute of So-

cial and Economic Research (ISER) and head of the project. Poverty and outdated perceptions among men and women about their respective sex roles limit the full exercise of women's authority and the full development of their potential. In fact, female heads of household appear to be disadvantaged, economically and otherwise, compared with male heads of household or with other women.

ECONOMIC CONSTRAINTS ON MEN

The idea that paternal irresponsibility is the reason that women are left to run, and fend for, their households is also called into question by the findings. "The island studies have shown that men in visiting relationships are not necessarily the uncommitted and irresponsible fathers we have been led to believe but that their capacity to function as they would wish is constrained by their limited economic circumstances," explains Dr Massiah.

The study also found that most Caribbean women believe they should have children but that marriage is not necessary. This has led to recommendations for the "democratization" of laws concerning nonlegal family unions. The study also pointed to the existence and importance of women farmers in the Caribbean.

"Those who plan to be on the front line in the struggle for change for women in the Caribbean societies cannot afford to ignore the information generated by WICP," says Professor Claudia Mitchell-Kernan of the University of California.

However, according to Dr Massiah, the results of studies on women often fail to

reach the appropriate audience because of insufficient funds. With WICP, though, things have been different: "We were fortunate with this project in that the subject of women was the in-thing at the time and we were able to attract funds." The project has published six monographs on women and the law, family, politics, stereotypes, education, and work. But compared with the information gathered by the project, the data so far analyzed and published represent only the tip of the iceberg.

In 1985, ISER asked IDRC to help establish an automated data retrieval system for WICP with the ability to update and add to the data already gathered. "The problem and the challenge was the qualitative material," says Ronald Archer, a program officer at IDRC. "That's the information that's really fascinating." The quantitative data had already been transferred to computer tapes, but some of the qualitative data — responses to open-ended questions and in-depth life history interviews — were still in the original questionnaires or transcribed onto index cards and stored in 22 file boxes.

The retrieval system developed is an "innovative way of handling survey data", according to Archer. Instead of indexing the responses into preconceived categories, ISER will use a "free-text" retrieval system that enables researchers to access the information using the actual words of the respondents.

ISER will use the University's new mainframe computer and a very user-friendly software system called Computer-Assisted Information Retrieval System (CAIRS) developed at the Food Research Association in England. The overall system could be linked with computer systems from other institutions to give users access to a comprehensive up-to-date data pool.

Both the quantitative and the new qualitative data bases can be merged and, as part of the testing process, ISER intends to produce several publications with information gathered from both data bases. Two data-entry operators have begun inputting the material but the process will take about nine months.

"What makes this project so interesting is the potential use of the data," says Pauline Oswitch, another program officer at IDRC who did the original feasibility study. The information will be used to reassess conventional concepts such as traditional sex roles, in light of the actual political, social, and cultural experiences of Caribbean women, and to develop policies that speak more to their needs. As Jamaican scholar and UN Under-Secretary General Dr Lucille Mair said at the 1982 WICP Conference in Barbados: "Today we feel pride and gratitude because we have a project which presents us with the unique reality of Caribbean womanhood."

The WICP findings are expected to be used by researchers, students, educators, development planners, and policymakers both at regional and international levels. Dr Mair adds: "The possibilities are endless." □

Frank Campbell, a former cabinet minister and ambassador for Guyana, is a journalist specializing in Caribbean affairs.

Peanuts? Never heard of them! Three years ago, that would have been the joking reply of Winit Chinsuwan, an agricultural engineer in northwest Thailand. Today, it is impossible to stem the flood of words, or fail to detect the obvious pride, with which this University of Khon Kaen professor broaches the subject of peanuts.

The reason for this turnaround? His own personal invention, quite simple in appearance, but one which can perform miracles for the ailing economy of this part of Thailand by improving the revenues of peanut producers.

In close cooperation with small producers in his corner of the country, Chinsuwan has developed a prototype peanut sheller which easily, quickly and, above all, inexpensively removes peanuts from their shells, while considerably reducing losses. The device consists of a wire mesh, on which the peanuts to be shelled are placed, and a tire, turned by a crank, which rubs along the mesh, freeing the peanuts from their shells.

"The effectiveness of this machine consists in the precision of the mechanism that adjusts the pressure of the tire against the mesh," says Chinsuwan. "The percentage of damaged peanuts is minimal, and the shelling is much faster than if it were done by hand."

IDEAL SUBSTITUTE

Tackling the problems of peanut production will give thousands of farmers in northwest Thailand the means to escape their current economic impasse — a predicament that has resulted from the dramatic fall in exports of cassava to the European market. Cultivating a stubborn soil, in an almost barren region with limited crop diversity, these farmers used to make their living by selling their principal cash crop, cassava, on the European livestock feed market.

The loss of that market is forcing them to consider alternative crops. "Peanut farming indisputably represents an ideal substitute, as the quality of the soil and climatic conditions in the northwest of the country do not adversely affect its growth," says Chinsuwan. "Moreover, the world price of peanuts is currently rising. For that reason, our government is according a great deal of importance, in its agrarian development plan, to intensifying this production."

Despite its future promise, the small farmers of Thailand, until recently, would have nothing to do with peanut cultivation. The reason was quite simple. With unmechanized or only partially mechanized operations, small farmers saw peanut cultivation as requiring an investment of time, energy, and money that far exceeded their means.

"It must be understood that peanut shelling alone demands an enormous amount of time," explains Chinsuwan. "Before sowing, the pods must be opened to remove the peanuts which are then placed in the ground. After harvesting, the pods must be detached from the stem, then opened in order to harvest the peanuts destined for sale or the next sowing." And by selling the peanuts pre-shelled, the producer can earn substantially more per hectare.

A few models of shellers already existed on the market when Chinsuwan began his

SELLING PEANUTS
THE EASY WAY

A BOOST TO THAI FARMERS

By DENIS MARCHAND



Photos: Denis Marchand

A simple shelling device made of readily available materials. The breakage rate is less than 3 percent.

research work, with the financial assistance of IDRC. His personal objective was not so much to perfect the devices already available, as to design a prototype sheller appropriate to the needs and means of the small farmers.

"Many peasants were not using the shellers available because they damaged the crop too much. I therefore came up with the idea of using an automobile tire as a pestle to open the shells. It works wonderfully well, and the percentage of peanuts broken during the operation is under 3 percent."

"The percentage of damaged peanuts is minimal, and the shelling is much faster than if it were done by hand."

The main advantages of the invention are the low purchase price (about US \$100) and ease of maintenance that one would expect with a relatively simple mechanism, as well as the availability of spare parts.

About 50 shellers have been built so far on the premises of the Faculty of Engineering where Chinsuwan works. Some are currently in use in several villages, where producers are putting them to the test. Chinsuwan is confident that his invention will be popular with farmers.

RENTAL STRATEGY

The final component of the research consists in developing a marketing strategy that would enable all small producers to take advantage of the technology without going into debt. Chinsuwan has proposed that the chief of a village purchase the sheller and then recover his investment by renting it to users. "According to my calculations, the invested capital can be recovered in one season if the total harvest exceeds 3000 kg. And the average harvest of a village normally varies between 8000 and 10 000 kg."

With his mission practically over, Professor Chinsuwan is unable to conceal his satisfaction. "You cannot know how pleased I am with the results achieved. I was used to wrestling with bigger problems, and yet here is a tool, a simple peanut sheller, that presented me with a difficult scientific challenge."

"Mechanizing the agriculture sector does not necessarily mean using big equipment. It can mean using a small machine like this one, tailored to the real needs of the environment. My research work on this sheller proves to me that the people in the developing countries have the ingenuity it takes to find appropriate solutions to their problems. Just give them the means . . . and have faith in them!" □

Denis Marchand is a freelance Canadian journalist.

ROCKS IN THE SERVICE OF SOIL

By GERRY TOOMEY



Joint effort: A farmer (left) in the village of Njelenje is a wealth of information for Tanzanian and Canadian geologists interested in local fertilizer use.

It is mid-October and southern Tanzania's Mbeya highlands will soon turn green with the rains. In the valley village of Njelenje, here in the southern flank of East Africa's great rift valley, farmers ready themselves by repairing their roofs.

Here and there, the hills and fields are charred black from the blazes set by the farmers in preparation for the planting of maize, beans, and garden vegetables. Combined with coffee growing, such subsistence agriculture is the backbone of the region's economy.

At twilight the darkened hills around Njelenje begin to twinkle with the flames of a hundred small grass fires. It is as if the valley were a giant mirror reflecting the starry southern firmament. On a hillside overlooking this scene, a team of Tanzanian and Canadian geologists have pitched tents and set up a prospecting camp. The goal of their research project, simply stated, is to help the farmers of the Mbeya, Morogoro, and Mbozi regions to improve their crop yields. Their Swahili motto, "chakula kwanza", is apt. It means "food first".

Geologists aiding farmers? Under normal circumstances, the first love of any geologist — rocks — is the last thing a farmer wants to see added to his fields. But that is exactly, or almost exactly, what this geological team hopes farmers will eventually do. They are prospecting in the hills for mineral deposits to provide farmers with an inexpensive source of fertilizer close to their fields. Much of the material would need to be crushed before being applied.

INFERTILE ACID SOILS

Coaxing crops from this land is not easy. The soil pH is often very low from millions of years of natural leaching by rainfall and, in some places, also from the increased use of acidifying fertilizers such as ammonium sulphate. Decades of intense cultivation due to population growth and the demand for exportable cash crops have also caused productivity to decline.

Keeping the tired soil fertile by adding standard NPK (nitrogen, phosphorus, potassium) fertilizers is expensive and, in the long

run, important micronutrients become depleted. "Adding weatherable rock to farm soils is an attempt to re-establish the smorgasbord of nutrient elements that plants need," says Dr Ward Chesworth, a geologist from the University of Guelph and leader of the Canadian part of the team.

What is significant about the current "agrogeological" work supported by IDRC, says project co-leader Dr Johnson Semoka, head of the department of soil science at Tanzania's Sokoine University of Agriculture, is that it may enable farmers to increase their yields by 50 to 70 percent, ensure that vital micronutrients are replaced, and at the same time cut their commercial fertilizer costs. "Farmers are rational and most likely they will go for this kind of option."

The project, conducted jointly by Sokoine and Guelph is breaking new ground — both literally and figuratively. The new field of "agrogeology", combining the wisdom of agriculturalists and geologists, isn't yet a distinct discipline, but it has placed geology — historically the exploration tool of the mining

ZEOLITES AND SCORIA

Zeolites are a mineral resource that the Tanzanian and Canadian "agrogeologists" are especially excited about.

These rocks have proven useful because their capacity to exchange ions permits them to make phosphate available to plants quickly. Dr Peter van Straaten, a geologist at the University of Guelph, who spent eight years working in Tanzania, says that laboratory tests at Guelph and elsewhere have shown that, over short periods, zeolite-treated apatite releases its phosphate into the soil up to 100 times faster than straight apatite.

Zeolites' ion exchange capacity can also do wonders for organic fertilizers. When mixed with manure, for example, zeolites prevent valuable nitrogen-rich ammonium from being volatilized too quickly, thereby making it available to plants. Zeolites are also good moisture retainers.

"It's been known by chemists and geologists for 10 to 15 years that zeolites have this capacity to 'trap' NH_4 (ammonium)," says van Straaten. "But even today in agricultural circles, this is not widely known."

The geologists are also examining the agricultural uses of abundant volcanic rocks called scoria. In particular, this glassy material may help overcome major chemical and physical problems in the region's highly leached acid soils.

The use of scoria to improve soil fertility is not new. In the Canary Islands, farmers have been putting it on their fields for two centuries.

Scoria also contains major and minor plant nutrients, improves soil structure, helps retain soil moisture because it is porous, and does not have to be crushed or processed before being spread on fields.

and energy sectors — at the service of agriculture.

Geologists normally explore for gems, petroleum, precious metals, and other minerals for industrial purposes, says Semoka, and have therefore ignored certain materials valuable to farmers. A geologist working for an industrial cement company, for example, will look for calcite (calcium carbonate) but ignore its close relative, dolomite (a combination of calcium carbonate and magnesium carbonate).

The agricultural scientist, on the other hand, sees dolomite as a valuable liming material (to raise soil pH) that also supplies two important nutrients, calcium and magnesium.

In experimenting with local geological resources, says Semoka, "we are trying to copy Nature's own way of replenishing soil nutrients." The way to do this, he says, is by adding fresh rock to the weathering cycle.

In Tanzania, fertilizer supplies dropped from 107 090 metric tonnes in 1980 to 82 475 tonnes in 1982. But the farmers' demand for fertilizer is steadily rising. In fact, the Food and Agriculture Organization predicts it will reach 225 000 tonnes by 1990.

So there isn't an adequate supply of locally produced commercial fertilizer in Tanzania and even when it is available many farmers simply can't afford to buy much, if any. In the case of fertilizer imports, controlled by the government, the same problem occurs. Delivery of supplies is unreliable and the government lacks foreign exchange to pay for adequate quantities.

The following paraphrases a description of the supply problem from a farmer's point of view, that of Mr V.J. Mabula of Njelenje:

A NEIGHBOURLY EXCHANGE

A major advance for the Tanzanian agrogeology project has been the establishment of a small phosphate-testing laboratory at one of the remote base camps. This was made possible by the transfer of a useful technology from neighboring Zambia.

Using a simple chemical analysis technique — a kind of litmus test for phosphate — a technician working in a small mud-and-straw lab can quickly and with reasonable precision determine the phosphate content of samples brought back by the field geologists.

Crushed rock samples in test tubes are treated with a special acid solution which turns them yellow. By matching the particular colour intensity of a sample against known standards, the technician can estimate the percentage of P_2O_5 .

This particular 'visual colorimetry' technique was developed by Zambian scientists from the Zambia Industrial and Mining Corporation (ZIMCO) and modified at the University of Guelph in Canada. The Zambians also provided training for the Tanzanian technician.

'A farmer may hear that fertilizer is available in Mbeya so he travels all the way there only to find out that it has not yet arrived. He is stuck with paying the bus fare and often the cost of putting himself up overnight. The next day he is told that the fertilizer shipment will not arrive for two more weeks so he goes home. Two weeks later he returns to town only to find that, yes, the fertilizer did arrive but that it has all been sold!'

The geological resources under investigation — phosphates (P_2O_5 bearing minerals), liming materials, rock mulches, and materials to speed up P_2O_5 release — would help eliminate such headaches because they would be located close to the farmers and easily mined and prepared by them or local entrepreneurs, according to Chesworth.

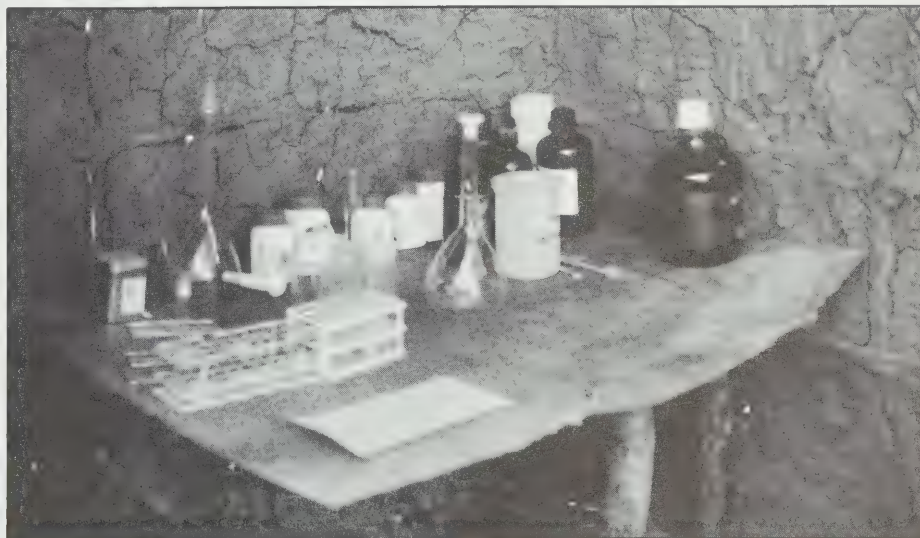
"But," Semoka cautions, "we must realize that this is not the solution to Tanzanian agriculture. The material we select cannot be applied as a blanket solution, but it is going to help in those areas where the soil conditions are right."

the farmers. But some carbonatites are difficult to grind and they must be modified to make the phosphate soluble enough to be taken up by plants. Experiments are being conducted at Guelph to try to overcome the problem.

In the case of the sedimentary phosphorites, solubility is not as big a problem, but the "occurrences" under investigation are some distance from the farmers' fields.

Investigations of local guano caves by the geologists revealed high percentages of phosphate not only in the actual guano but also in the intermediate layer between the guano and the underlying rock. But the overall volume of the deposit was unfortunately too small to be viable.

While the geological team has been prospecting, Semoka and his agricultural team have begun collecting and classifying soil samples from the three target regions according to properties such as pH and levels of available phosphorus. The Uyole Agricultural Centre in Mbeya and the Univer-



A simple field lab allows geologists to find out quickly whether rock samples contain phosphate.

During the first year of the project, the emphasis has been on geological exploration. Phosphate, the principal target, is important because it is a major plant nutrient severely lacking in many of the region's soils. (Other geological resources are also being investigated. See 'Zeolites and scoria'.)

About 80 percent of the world's P_2O_5 reserves are sedimentary in origin, 20 percent are igneous, with a tiny fraction accounted for by guano (bird or bat excrement). Two teams of geologists from Madini (the Geological Survey of Tanzania), Stamico (State Mining Corporation), and the University of Guelph have been investigating such phosphate sources in the Mbeya region. In particular, they have been working with carbonatites (igneous intrusions), lake sediment phosphorites, and caves containing bat guano.

The carbonatites are particularly promising not only because some contain a mineral called apatite, which in its pure form is 42 percent P_2O_5 , but also because they are good liming agents. In the Mbeya area, the carbonatite bodies and associated phosphate-rich soil examined by the geologists have the advantage of being close to

sity of Guelph have assisted them with the chemical analysis and with potted plant trials. The latter work, with beans and maize, will give the researchers a preliminary understanding of the effects of geological materials on plant growth, laying the groundwork for later field trials.

A little later in the project, the researchers will be experimenting with simple, inexpensive rock-grinding devices, perhaps animal-powered, suitable for use by small farmers.

In the longer term, the agriculturalists will be able to specify which combination of materials goes best with which soil and this information will be passed on to farmers via the country's agricultural extension system.

The marriage of agricultural science and geology holds out great potential for Africa's farmers. Many African countries realize this, and some of them are now planning an agrogeology network to foster cooperation between the two disciplines.

Given the continent's worsening food deficit, there is an obvious need for strict national policies that place "food first". In pursuing these, Africans have absolutely nothing to lose by attempting to turn natural geological wealth into food. □



WHITE GIANTS OF THE H

If the mountain won't come to you, you must go to the mountain. A team of Canadian and Pakistani researchers have taken this saying literally, surveying for a second consecutive year the high-perched glaciers of the Karakoran massif, in northern Pakistan, with the avowed intention of probing all their secrets.

It is not the taste for adventure which pushes them to scale on foot, with their scientific gear on their backs, the 4500 or more

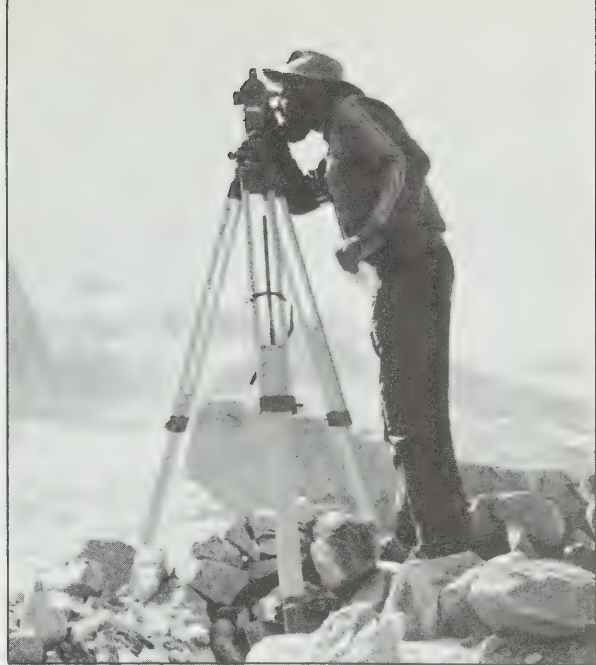
metres that separate the lowlands of the Indus valley from their work site. Their objective is far more important: to gather crucial data on the melting of the snow and glaciers in order to design an effective water management model for the Pakistani authorities.

Every summer these Himalayan glaciers send their meltwaters into the Indus River. More than 80 percent of the waters that feed the river come from the melting snow and

glaciers of the upper Indus basin. The instability of this water supply poses a constant threat to the country's hydroelectric projects and irrigation programs.

ARMED WITH ELECTRONICS

With the financial assistance of IDRC, the Pakistan Water and Power Development Authority (WAPDA) has linked up its en-



Above: A researcher observes the sea of ice before him. More precise knowledge of the melting process will enable authorities to control the flow of Pakistan's life-sustaining Indus River.



Main photo and top centre: Pakistan's main reserve of fresh water, its glaciers, is located in the Karakoram Massif in the north of the country. The need to better understand this important resource has prompted a team of Canadian and Pakistani scientists to undertake a major research project. At an altitude of 4500 m, they have established a camp as well as a laboratory for analyzing their snow, ice, and sediment samples.

Left: It snows on the glacier, but the work must go on. Two team members use high-precision instruments to measure various characteristics of the snow such as accumulation, temperature, and speed of melting.

ALAYAS

Text by MARTHE LEMERY

Photos by FES DE SCALLY

ineers with a team of glacial hydrology experts from Sir Wilfrid Laurier University in Waterloo, Ontario, and Canada's federal department of the environment. Together, they will try to find an effective method for predicting, from one summer to the next, the quantity of water released by the glaciers. Armed with a battery of electronic measuring devices and microcomputers, these geologists, engineers, and glaciologists have been criss-crossing the surface of the prin-

cipal glaciers for two years now, taking their samples.

COMPUTER MODEL

Various geological and climatic parameters are being carefully studied to determine the probable level of melting.

This quest for information should lead to the development of a computerized water

management model, based on a scientific knowledge of the behaviour of glaciers. Such a model would be invaluable to the authorities of WAPDA, who could then regulate more effectively the flow of the Indus by opening or closing dams along the river, according to projections of glacial melting. □

Marthe Lemery is a Canadian freelance writer.



Syrian farmers dig an irrigation ditch in a field of faba beans.

BREEDING BETTER LEGUMES

FABA BEANS, CHICKPEAS, AND LENTILS

By LYNN TEO SIMARSKI

Egyptian street vendors are famous for fried *falafel*, a nutritious snack prepared with faba beans. In Syria, *shorbat ads* — lentil soup — is a winter favourite. And in parts of North Africa and the Middle East, millions snack on *hummus*, a chickpea-sesame dip.

These and an array of other Middle Eastern dishes are made from legumes, dietary staples generally containing two to four times the protein of cereals, and hence known as the poor man's meat. Legumes are often a cash crop for the small-scale farmer, and they also supply straw for animal feed. The "big three" legumes — faba beans, lentils, and chickpeas — account for about two-thirds of food legumes produced in the Middle East and North Africa.

The region's production of these pulses has declined over the past 20 years. The Green Revolution, focusing on better cereals, largely ignored legumes, and 13 years ago, only two scientists were doing food legume research full time in the entire area.

Since 1975, however, IDRC has funded the development of an informal network on food legumes, as part of its support for applied research on basic food crops. Funding has been given to national legume programs in the region, to the International

Center for Agricultural Research in the Dry Areas (ICARDA), based in Aleppo, Syria, and to several Canadian institutions. All conduct research on lentils, chickpeas, and faba beans.

Legumes fit well into crop rotations because they add nitrogen naturally to the soil, saving the farmer the cost of artificial nitrogen fertilizer. Bacteria living in legume roots take nitrogen directly from the atmosphere, which is then used by the legumes for growth. Surplus nitrogen helps nourish subsequent crops such as cereals.

"One major constraint in the region to better legumes with more stable yields is the use of landraces, or local types, which are low-yielding and susceptible to diseases, pests, and the parasitic weed *Orobanche*," explains Dr Mohan Saxena, leader of ICARDA's food legume research. Another problem is that farmers need better methods of growing the crops.

'PRACTICAL MONEY'

Network support has focused on two fronts: the research programs of key legume-producing countries in the region, and ICARDA's food legume program. The countries receive "practical money", explains Gordon Potts, a Cairo-based program officer with

IDRC's Crops and Animal Production Systems Program. "The scientists appreciate the experience in research management that it provides. In some cases, it's the first time scientists have a chance to manage their own research funds."

The network is decentralized, without the need for complicated legal agreements. "Our approach is to support each country's program, with research priorities set by the local scientists," says Dr Fawzy Kishk, IDRC regional director in Cairo.

At ICARDA, 241 researchers and technicians from the region have been trained in legume research. The network has also linked scientists through visits to other research sites and through legume germ-plasm exchange. Every year ICARDA sends out selected legume varieties to regional cooperants for evaluation of their characteristics under local conditions. Results are sent back to ICARDA's breeders so that they can make further selections.

The first country in the network was Egypt, whose research on faba beans, lentils, and chickpeas received funding beginning in 1975. The Egyptian scientists' success since then has attracted other donors. The International Fund for Agricultural Development, for example, now supports the Nile Valley Project, an exemplary joint effort between

Egypt, Sudan, and Ethiopia to boost faba bean production.

DOUBLE YIELDS

Farmers and scientists, cooperating in an on-farm testing program, have come up with simple production packages that could almost double yields and increase farmers' incomes in Egypt and Sudan. They have identified lines resistant to chocolate spot disease in Egypt (using germplasm from Ecuador supplied by ICARDA). Other lines resistant to root rot and viruses were identified in Sudan.

Another success has been Giza 402, the first commercial variety to resist *Orobanche*. The researchers have also developed chemical weed controls for faba beans.

IDRC's support for Sudan, initiated in 1978, concentrated on faba and field beans, lentils, and chickpeas. "We have been able to assist research activity in a very isolated research station in northern Sudan," explains Potts. "It takes about 8 hours by bus and 12 by train from Khartoum to reach

Hudeiba Research Station. IDRC funds field operations, travel, publications, training, and consultancies, all of which have allowed the researchers to maintain a level of activity, impossible with only local funding."

As the network took off, other countries were added: Jordan, Turkey, Tunisia, and Morocco. In Jordan, a new legume program, primarily concerned with lentils, chickpeas, and the mechanized harvest of both, was financed at the University of Jordan, where technicians and graduate students were trained. They now carry out an extensive program of varietal and agronomic testing at several sites in the country.

In Turkey, which appointed its first legume research coordinator in 1983, the needs were different. Local funds were sufficient for basic breeding work, so outside support went to master's level training in legume breeding, processing, and agronomy.

Over the period of IDRC support, Turkey developed lentil varieties which are now ready for release. Three chickpea varieties were given to farmers in 1985 and faba beans, being tested on farms near Izmir, may be released to farmers this year.

Across the Mediterranean, in North Africa, farmers need legume genotypes suited to a colder and more humid climate than in West Asia. These could not be developed

earlier to exploit the entire rainy season. If the varieties were used throughout the entire Mediterranean region, chickpea production could double. ICARDA lines are being modified in 16 countries, from Morocco to Afghanistan, to surmount frost and ascochyta blight disease, the two main hazards of winter sowing.

In North Africa, networking has paid off. "Researchers in Tunisia have incorporated resistance to root rot and wilt into chickpeas we sent, which were already resistant to ascochyta blight," says Saxena. Both Tunisia and Morocco have field-tested the new winter chickpeas, and have identified faba beans tolerant to chocolate spot and ascochyta blight. In addition, Tunisian and ICARDA scientists have come up with recommendations for weed control, planting dates, and fertilizer for chickpeas, faba beans, and lentils.

A major bottleneck to legume production in the region is the lack of mechanization, particularly of the lentil harvest. The region's farmers, who grow lentils almost entirely by hand, are currently caught in a labour crunch, particularly at harvest. Farmers are switching to other crops, such as cereals, that may bring better profits, partly because cereal growing is more mechanized.

IDRC has provided financial backup for an

THE CANADIAN CONNECTION

A major component of the IDRC-supported food legume network in the Middle East and North Africa is research conducted jointly by the International Center for Agricultural Research in the Dry Areas (ICARDA) and Canadian institutions.

"These projects tackle problems that ICARDA or a given country cannot handle alone because of limits on facilities and human resources," says ICARDA's Dr Mohan Saxena. "For example, a lentil haploid project with the University of Manitoba could produce a technique to hasten the development of new varieties. This method could cut the breeding cycle from four years to one."

Among other such projects is a study of legumes' nitrogen-fixing bacteria, or rhizobia, also with the University of Manitoba. What's needed, explains Saxena, is an inexpensive, effective "carrier" on which the rhizobia can be given to farmers. This is important if legumes are to be grown in new areas where rhizobia do not naturally occur in the soil, or if newly identified rhizobial strains are to be distributed to legume-producing areas to enhance soil nitrogen. Sugar beet pulp and a soil-carbon mixture are potential carriers under study.

Another area of collaboration with Canadians is legume information. Network members stay in touch through IDRC-funded information services on lentils and faba beans run by ICARDA. ICARDA collaborates with the University of Saskatchewan in running the Lentil Information Service. Scientists worldwide can draw upon ICARDA's extensive reference collection and receive LENS and FABIS, regular newsletters on the two crops.

Lack of mechanization has seriously hindered the harvesting of lentils.



Photo: Murat Serai-Eddin

at ICARDA's research farm in Aleppo. As ICARDA's Dr Saxena explains, "We had varieties resistant to a pest or disease that were not adapted to North Africa. So Tunisia became the site for a regional nursery where crop lines could be sent for modification at an early stage. The country did not have a full-time food legume breeder, however, so in 1981, ICARDA began to support a breeder and a research associate there. The goal has been to develop a core program which will later expand to the rest of the Maghreb — Morocco, Algeria, and Libya."

Part of ICARDA's role in the network is to tackle the basic problems of food legume research. One example is the decline in chickpea yields over the past 30 years. Although the region's chickpea acreage went up 14 percent over the period, production increased only 11 percent.

NEW VARIETIES PLANTED EARLIER

ICARDA researchers, along with the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), based in India, have developed large-seeded chickpeas with twice the yields of traditional spring-sown types. The new lines can be planted

interdisciplinary team of ICARDA breeders, agronomists, social scientists, and engineers to evaluate alternative methods of mechanizing the harvest. This year they will test the machines at farms in northern Syria where about 70 percent of the country's lentils are grown. An ICARDA training course for researchers in the region will review methods of evaluating the machines on the farm. The goal is for researchers all over the Middle East and North Africa to test the alternative technologies under their local production conditions.

As Potts sees it, "One of the most solid and long-lasting results of the network is the training of personnel and the establishment of national programs in food legumes."

IDRC will have directly sponsored about 20 food legume trainees at ICARDA by the end of the year. Many former trainees are already spearheading legume research in their countries, guiding programs that did not exist 15 years ago. As members of the network, they aim to ensure that legumes will again compete economically in a region where they have been grown for centuries. □

Lynn Teo Simarski is an agricultural writer, formerly on staff at ICARDA, in Aleppo, Syria.

EDUCATION IN KAMPUCHEA

By JEAN LASH



Parents are keenly involved in the construction of schools.

On September 27, 1984, Kampucheans woke up to the sounds of festive music and speeches. The country was celebrating the beginning of the sixth school year since the Vietnamese toppled the Khmer Rouge and installed the current government of Heng Samrin on January 7, 1979.

The official celebrations took place at the school of Wat Kos in Phnom Penh. It is a large ochre-colored building with a record 7000 students from pre-school through secondary levels. The scene was alive with the students' blue and white uniforms decorated with bright red scarfs.

The ceremony passed quickly from speeches covering the country's progress in the field of education to the continuing challenge of providing adequate teaching space and materials.

Education has been given a central role in the reconstruction of Kampuchea and in promoting the development of socialism. But after five years, there are still many gaps in the system and further progress in education will be stunted as long as the precarious political situation in Indochina continues to weaken the countries of the region.

The Khmer Rouge marched into Phnom Penh on April 17, 1975, ending five years of civil war and intensive American bombing. It established the communist government of Democratic Kampuchea and immediately cut itself off from the rest of the world.

It was not until the Vietnamese invaded and ousted the Khmer Rouge that the world faced up to the tragedy of Kampuchea. As many as two million people died as a result of starvation, slave labour, disease, and execution. There were no telephones, no postal system, and no currency. Industry was virtually nonexistent as were electricity, clean water, and sanitation.

SCHOOL USED AS PRISON

Only a handful of teachers and trained administrators survived. Schools and books had been destroyed with the aim of eliminating everything connected with learning. The school of Tuol Sleng in Phnom Penh, for ex-

Further progress in education will be stunted as long as the precarious political situation in Indochina continues to weaken the countries of the region.

ample, had been turned into a prison and torture chamber.

In the first days of the new Vietnamese-backed regime, all efforts were made to get children into school. Pressure from parents to enroll their children was spontaneous and widespread. Education and literacy were seen as a basis on which to rebuild confidence, security, and cultural identity.

But the Heng Samrin government has never been recognized by the United Nations and the normal sources of multilateral and bilateral aid needed to develop the country have been cut off.

Even though the Kampuchean infrastructure is weak, loans from UN agencies, such as the UN Development Programme, the UN Fund for Population Activities, and Unesco, are not available. Unicef, the Food and Agriculture Organization, and the World Food Programme have small programs in

Kampuchea, but they are restricted to humanitarian aid.

Development projects are limited by the small budgets of voluntary agencies in Phnom Penh. To survive in this situation, the government has had to look inward and develop its own resources.

QUANTITATIVE GROWTH

Initially, efforts were focused on primary schools and teacher training. Scarce resources were devoted to quantitative growth of the system rather than to the establishment of standards of quality. Buildings were allocated, however poorly equipped, and teachers were placed in the classrooms, however scant their training.

In 1979, the school children were in poor physical condition and discipline was a serious problem. Mrs Mon Miech Savarak, assistant director of one of Phnom Penh's model schools, explained that most of the children had never been to school although many were more than 10 years old.

The backlog of children in the 14 to 20 age group, whose education had been interrupted for four years, was enormous. A quarter of the illiterate "adults" were youths of 14 to 16 — too old to integrate into the normal system, but for whom education was considered crucial to national development. A system parallel to the primary cycle, covering seven years in two, was developed to integrate these children into society quickly.

There were over 900 000 pupils in primary school in the first year after the Heng Samrin government took power, "the same number as in the time of Sihanouk" (pre-war Cambodia), the Ministry of Education's "Chef de Cabinet," Mr Mom Chin Huy, proudly pointed out. However, most of the teachers were ill-equipped for the job. Training was to be improved slowly, through upgrading courses during school breaks. Teacher training, however, proved to be a major bottleneck in the improvement of education.

DIFFICULTIES IN BOOK DISTRIBUTION

Books and curriculum were also a problem. The 39 Khmer-language textbooks written by 1980 — much of their content was based on outdated materials — were sent to neighboring Vietnam for printing. By March, only six had been produced. Distribution within the country was even more difficult because the few trucks available were needed to distribute food.

From this shaky foundation, the education system has grown steadily.

Teacher training has been a priority from the start and by 1981 a network of teacher training centres had been established throughout the country. Each of the 20 provinces has a training centre for lower-primary teachers and there are two schools in Phnom Penh for secondary school teachers, general upgrading, and research into education.

Today the urgency and ad hoc approach of the early days have been replaced by a regular system. Upper- and lower-primary school teachers are recruited after completing the seven years of primary school, the former receiving one year of specialized

training and the latter three. Secondary school teachers receive three years of training after completing the full 10 years of primary and secondary school.

It is claimed that 66 percent of the formerly illiterate population can now read and write. Four years of primary school are compulsory and 1.5 million pupils are registered in the lower level. The Ministry of Education says



Photos: Jean Lash

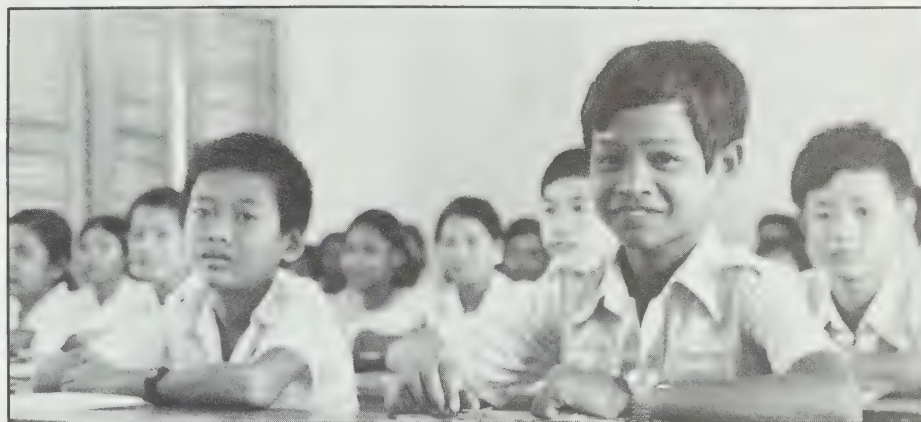
Some 200 000 students attend primary school but only 10 000 are enrolled at the secondary level. The government is now concentrating on the latter.

education, the authorities also give credit to the concept of emulation — the designation of avant-garde students and model schools. A model school is chosen on the basis of achievement. Its students must be disciplined, studious, and patriotic, and the parents' association should have made extra contributions to equip and organize the school.

Once the criteria are met and the status of model school established, more support from the Ministry, in the form of the best teachers and materials, is made available. Mom Chim Huy described the concept as the "locomotive which pulls the train". These schools set the example for the nation.

MANUAL WORK FOUR HOURS A WEEK

The educational structure is modelled on Vietnam's: four years lower primary, three



In justifying this policy, the authorities claim that after seven years of schooling children are equipped to live in society, to work, and to produce. Technical courses are part of the regular curriculum, explained the Chef de Cabinet, and therefore at least some training is accessible to all students.

Officials readily acknowledge that the quality of education has not kept up with the quantity. The continuing shortages of school administrators, teachers, and basic materials fall far short of their "revolutionary aspirations" for education.

ABSENCE OF TEACHING AIDS

While there have been innovations in pre-school, adult education, and mass literacy programs, the approach for primary and secondary schools has been traditional. Without a solid infrastructure, both human

the attendance level of lower-primary school-children in Phnom Penh is 100 percent, but the average throughout the country is probably closer to 80 percent and about 70 percent in some of the poorer outlying provinces. With more than 200 000 students registered in upper-primary school, Mom Chim Huy seemed confident that the Ministry could meet its objective of making seven years of schooling compulsory by the end of the decade.

SOCIALIST CURRICULUM

Ninety-one Khmer-language textbooks have been produced and distributed and all "conform to the principles of the new socialist education". All teaching is in the Khmer language and to date no foreign languages are studied.

While help has been forthcoming from "friendly socialist countries" and international organizations such as Unicef, the efforts of the Kampucheans are impressive. Parents not only contribute school supplies but also participate in the construction of school buildings. The Ministry provides teachers, textbooks, and a standard curriculum, but the community itself remains an important source of funds. On virtually every trip outside of Phnom Penh, travellers are flagged down and asked to donate a little money to cover the cost of cement or roofing materials.

In explaining Kampuchea's progress in

years upper primary, and three years secondary. At least four hours a week of manual work is combined with academic studies. While the type of work varies from school to school, a typical breakdown is two hours in agriculture and two in technical work.

Today there are only slightly more than 200 000 children in upper-primary schools and as few as 10 000 in secondary schools.

Parents not only contribute school supplies but also participate in the construction of school buildings.

However, the same concerted effort is now being made to improve access to the upper-primary level as was made for the lower level.

At the secondary level, the lack of qualified teachers is exacerbated by the lack of eligible recruits. Only a minority of students completing seven years are able to continue their studies. Most are expected to enter one of three alternative channels. Some compete for a small number of places in professional and technical schools; others enter the labour force (mainly as farm workers); some join the army.

and material, the only technology available to convey the "new socialist education" is the classroom pupil-teacher relationship. Given the absence of even the most basic teaching aids, one is justified in questioning just how well equipped these children are may be more than a problem of numbers or training. The low salaries of all government employees make teaching less attractive than medicine, for example, where the opportunities to earn extra income are greater.

Another problem that could emerge is that of how to keep school leavers working in agriculture. The system of education appears to have an urban bias, and as the population becomes better educated, expectations for government jobs or other employment in the capital could work to the detriment of rice cultivation.

These problems aside, Kampucheans working out of Phnom Penh have demonstrated rapid progress in the field of education despite their lack of resources. Administrators in the Ministry of Education, teachers, parents, and students are still persisting against the odds and the system continues to improve. But sadly, too many of the country's resources are being diverted to a political struggle whose resolution remains elusive and, in many ways, beyond their control. □

Jean Lash works with Oxfam in Phnom Penh.

WITH OUR OWN HANDS



Cooperation between agricultural scientists and farmers has given rise to a whole new methodology of on-farm research.

‘We too have ideas even though we are called underdeveloped, poor and illiterate. Even though in our countries the basic needs are not fully met, we can engage in the highest intellectual activities. We too can invent, innovate, create. And, who knows, we will probably find the solutions to underdevelopment by building our countries with our own hands.’

These sentences may not be found word for word in *With Our Own Hands*, which IDRC has just published after its first 15 years of operation. But in one way or another, they summarize the principle that underlies the existence of the International Development Research Centre.

NO TECHNOLOGY WITHOUT ROOTS

The book is divided into two distinct parts: in the first, synthesis and analysis; in the second, 10 examples of research carried out in developing countries with IDRC support.

cond, 10 examples of research carried out in developing countries with IDRC support.

The professional development of the individuals involved is also one of the most important results expected.

The introductory chapter is a critical analysis of the following chapters. Its author is Hugh Wynne-Edwards, vice-president (research and development) and senior scientist for Alcan International Limited. He argues that within a society technical progress can be realized only by building on what is al-

ready in place in that society. Real technological dynamism appears when innovation in the society flows from the improvement of existing technology. For Wynne-Edwards, IDRC's approach, consisting of funding researchers and institutions in the developing countries, perfectly reflects this process.

Based on an analysis by Guyanese journalist and ex-diplomat Frank Campbell, the second chapter takes stock of the important advantages enjoyed by developing countries anxious to develop their scientific and technical capabilities. Indeed, it is demonstrated once and for all that the links between economic growth and scientific and technical activity also apply to countries other than those whose industrialization began during the first industrial revolution 200 years ago. However, Korea, India, Brazil, and a few other newly industrialized countries remain exceptions in the Third World. The chapter ends with the observation that scientific research is necessary to development, that it has even begun to bear fruit, but that it alone cannot ensure development.

The third chapter, by the same author, is the most detailed. Campbell retraces the history of the founding of IDRC, and describes its unique character and objectives.

\$500 MILLION SPENT

IDRC is entirely funded by Canada. It recruits its staff members from around the world, but they are not considered part of the Public Service of Canada. Its independence vis-à-vis the Canadian Government and its international character are assured by a 21-member Board of Governors, 11 of whom must be Canadian citizens. By tradition, six governors are scientists from developing countries, with the other four being experts in international development from various industrialized countries.

The Canadian Act of Parliament that created IDRC authorized it both to carry out and to fund research. In practice, owing to the guiding influence of the governors, the funding activity, particularly for research conceived and carried out by scientists from developing countries, has been the more important activity.

During its 15 years of existence, IDRC has expended approximately \$500 million, or about 3 percent of the \$16 billion earmarked for Official Development Assistance (ODA) by the Government of Canada during the same period. For 1985/86, the Centre's budget totalled \$86 million, accounting for 4 percent of ODA.

2000 PROJECTS, 10 000 SCIENTISTS

Ordinarily, the Centre funds clearly defined research carried out by a team from an institution in a developing country. At IDRC, each grant is called a project. In total, 900 institutions in 100 or so countries have completed more than 2000 projects, with the cost of an average project usually running between \$100 000 and \$200 000. In addition, some projects cost only a few thousand dollars, while one project grant was \$1.1 million.

The specific scientific results of each research project are important, but for IDRC, the professional development of the individuals involved is also one of the most important results expected.

Approximately 7000 persons have been able to take part in recognized training programs. Of the 6000 of these who have done so within the framework of IDRC-supported projects, about one-quarter were enrolled in a program leading to a diploma, in most cases a Bachelor's or Master's degree. A sampling of 750 IDRC grant holders revealed a remarkable statistic: 97 percent of those who had studied abroad returned to their countries. This high "brain conservation" factor may be explained by the nature of the training, that is, by the fact that research is carried out in the grant holder's country of origin.

In total, some 10 000 researchers from developing countries have improved their skills through IDRC projects, without counting hundreds of librarians, electronic data processing professionals, science journalists, and administrators in research institutions. In addition, 700 Canadian scientists have worked on IDRC projects. *With Our Own Hands* gives a few examples of people whose scientific stature has been enhanced through IDRC. In one case, a researcher from the Philippines, who was able to develop improved varieties of sweet potato, not only achieved national recognition but turned this "poor man's crop" into an important economic resource on a national scale.

PROMOTION OF TEAMWORK

Teams and institutions have also benefited greatly from Centre grants. In Brazil, a vaccine research institute now uses the tissue culture technique to produce a new vaccine against yellow fever. In Tanzania, a former department of the University of Dar-es-Salaam is now a full-fledged university devoted to agriculture, after having successfully completed numerous research projects, including a dozen sponsored by IDRC. And in Cameroon, the government is henceforth assuming responsibility for a national research project on tubers, of which the initial work was carried out in collaboration with IDRC.

For years the Centre supported the research work of a number of Argentinian economists, and with the recent democratization of the country, some of these people have been catapulted to the highest echelons of the government.

The numerous projects funded have also made a contribution to the pool of scientific and technical information: 500 publications produced by IDRC, 700 articles published in scientific periodicals, 25 documentary films available in about 20 languages, as well as hundreds of general interest articles published in this magazine, now in its 15th year of operation.

BULK RESULTS

The third chapter also presents some of the most important results of the research projects. Through these IDRC has made a decisive contribution to improving collaboration between researchers and farmers in the developing countries. Indeed, an entire methodology for "on-farm research" has come into being. In addition, the Centre promotes "research-action" and "participato-

ry research", approaches in which the communities work closely with scientists.

In the area of health sciences, the Centre has, among other things, assisted in the development of a handpump now manufactured and installed by women. In Latin America, researchers have invented a tape for measuring arm size which can be used by illiterate persons to determine the nutritional condition of children with an accuracy of between 78 and 98 percent. In Africa, complex research has helped to explain how, under certain circumstances, cassava-consuming populations could be affected by goitre and cretinism.

In agriculture, the development of a sorghum, millet, and corn dehuller, now used in dozens of flour mills, has created new markets for local food products. First perfected and distributed in Africa, the device is now enjoying a growing success in India. A series of research projects, some of which are in progress, has contributed to re-asserting the value of traditional African silos which,

DISCOVERING THE REAL PROBLEM

The last 10 chapters of *With Our Own Hands*, which would require too much space to summarize here, contain numerous other examples of the creative activity of intellectuals and scientists in the Third World. The very last chapter is a must. With candour, the researchers of the International Potato Center, in Lima, Peru, tell how they undertook to assist small farmers by trying to reduce their losses, only to discover that in the eyes of the farmers, these losses did not exist. Spoiled or second-grade potatoes were in fact used to produce dried potatoes (for adding to soups) or to feed farm animals.

After a dialogue with the intended beneficiaries of their work, the researchers did discover a real problem: that of storing potatoes used for seed. It was difficult to stop them from sprouting while keeping them fit for consumption, in case of a food shortage. The researchers fully redeemed themselves



IDRC has helped about 10 000 developing country scientists to improve their skills.

with a few improvements, are quite effective.

In the information sciences, the most easily measurable success is undoubtedly that of MINISIS, a bibliographic software package available in a dozen languages, including Arabic and Chinese, and now used by 145 institutions in 41 countries.

*Some 10 000 researchers
from developing countries
have improved their skills
through IDRC projects.*

In the social sciences, projects have shown the academic potential of young people in the rural regions of Latin America, as well as that of women. In Thailand particularly, one research project led to the establishment of new procedures to help women to obtain bank loans more easily.

by proposing a seed potato preservation technique so simple and inexpensive that it is now used in 21 countries. It is a good example of the "on-farm research" concept that IDRC has been actively promoting in many countries.

Finally, to return to another example from the third chapter . . . Economists from the Pontificia Universidad Catolica de Rio de Janeiro proposed an original and complex plan for fighting the hyperinflation from which Brazil has been suffering. The weekly magazine *The Economist* thought their work worthy of an article (edition of March 30, 1985) — perhaps a good indication that it's worth the trouble to encourage such ideas. □



Due to the 'one-child' policy, China's population growth rate is now about the same as the industrialized world's.

THE ONE-CHILD SOLUTION

DECLINING FERTILITY IN CHINA

By DR CAROL VLASSOFF

China is undergoing a demographic transition with a rapidity never before experienced in the history of mankind.

Crude birthrates plummeted from an estimated high of about 50 births per thousand population in 1963 to only 21 in 1983. Death rates also declined markedly. As a result, the population growth rate during the 1980-85 period — 1.17 percent per year — approximated that of the industrialized world.

These dramatic declines have been attributed largely to China's vigorous family planning program, the promotion of one-child families, and a system of related rewards and penalties. The goal is to halt population growth by the year 2000 at 1.2 billion, and gradually to reduce the population size in the years thereafter.

Chinese authorities have devoted considerable attention to research on population characteristics and trends in the past few years. This represents a major boost in the status of demography in the People's Republic.

Demographic statistics used to be based mostly on speculation and inferences from press reports, with occasional references to

a little known official population registration system. Since 1982, however, information has been collected and reported in a vigorous manner from a number of sources: registration figures for births, deaths, and year-end population totals from 1950 to 1982; the 1982 population census, which was conducted with meticulous care; a 10 percent sample survey of census questionnaires; and a one-per-thousand sample fertility survey, also conducted in 1982.

The use of birth control in China approximates that of the industrialized countries.

The most current contributions to China's growing bank of demographic information are coming from an in-depth fertility survey conducted in April 1985 by the State Statistical Bureau (SSB).

Assistance was provided by IDRC and Norwegian and Danish donors. IDRC's role was to provide training for the Chinese

researchers in the survey design and methodology.

The results, once compiled and analyzed, will provide a wealth of information on fertility, contraception, abortion, infant mortality, family size preferences, and attitudes toward government policy — subjects never before investigated in detail in China.

The survey covered two provinces, Hebei and Shaanxi, and one municipality, Shanghai. These areas contain about 10 percent of China's total population. Hebei is typical of the coastal provinces of northern China; Shaanxi, of the inland regions; and Shanghai, of the large metropolitan centres.

In each area a random sample of 5000-7000 households was selected. From these, all women of child-bearing age who had ever been married were interviewed, amounting to more than 13 000 respondents.

The quality of the data was exceptional, as was the speed with which they were collected. The remarkably high response rate of more than 95 percent in each of the three areas reflects both the dedication of the survey team members and the enthusiastic cooperation of the respondents.

The interviewers, many of whom held other jobs as family planning workers, worked late into the night studying for examinations designed to assess their readiness to undertake the fieldwork. "Unless we obtained marks of over 90 percent," explained one interviewer, "we were not allowed to participate. We didn't do it for money, only as part of our regular jobs. It was a wonderful opportunity to learn how to conduct a scientific survey."

As for the high level of public participation, it can largely be explained by the pre-survey efforts of the research team. "The survey was advertised in advance in newspapers and billboards," said one of the survey supervisors, "and people were urged to cooperate. This meant that they were prepared for the survey and even felt honoured to be chosen. We also arranged interview times to suit the women so that the questionnaire was not viewed as an inconvenience but rather as a novel, and even special, event."

The preliminary tabulations now available contain a number of interesting insights. And the information appears to be remarkably consistent with the 1982 census results and other sources.

The success of China's family planning program is demonstrated by a dramatic fall in fertility. The total fertility rate (TFR) — roughly the number of children per completed family — declined from 5.4 in the 1940s to 2.6 in 1981 for the country as a whole.

The 1985 in-depth survey revealed further declines, at least for the three study areas, with TFRs of 2.4, 2.3, and 1.1 in Hebei, Shaanxi, and Shanghai, respectively. These large rural-urban differences between the provinces and Shanghai are attributed by Chinese researchers to the greater intensity of family planning programs in urban areas. They conclude that if China's population growth is to be halted at the 1.2 billion mark by the year 2000, family planning efforts will have to be concentrated in rural areas.

Another important factor contributing to lower fertility is the transition to later marrying ages of women over the past 30 years. The in-depth survey revealed that in Shanghai, for example, 42 percent of the oldest cohort of women (aged 45–49) were married during their teens, compared with only 3 percent of those aged 20–24. This increase in age at marriage is mainly the result of a national policy encouraging delayed marriage and of a weakening of the tradition of arranged marriages.

The use of birth control in China approximates that of the industrialized countries, with about 70 percent of married women of reproductive ages practicing contraception in 1982. In the three surveyed areas, 70–80 percent of the women interviewed had used at least one family planning method, and the large majority were practicing birth control at the time of the study: 83 percent in Shanghai, 76 percent in Hebei, and 69 percent in Shaanxi.

Chinese researchers were concerned that a small but significant proportion of women were not using birth control but already had one or two children. These were seen as the most important target for family planning information.

Since 1979, in keeping with the one-child-per-family policy, the Chinese government has been issuing single-child certificates to

couples with one baby who pledge to have no more. In 1982, the one-per-thousand survey revealed that 43 percent of single-offspring mothers had accepted the one-child certificate. Only 6 percent of certificate holders interviewed had failed to maintain their pledge, nearly all of them from rural areas.

Infant deaths among certificate-holding families were amazingly rare. Family planning officers attributed this to the fact that an only child is better cared for because by law he or she is entitled to superior medical services. Furthermore, an only child does not have to compete with siblings for parental care and attention.

If China's population growth is to be halted at the 1.2 billion mark by the year 2000, family planning efforts will have to be concentrated in rural areas.

Following the traditional Chinese preference for male offspring, 60 percent of the certified children were boys, 40 percent girls. In effect, couples were more likely to agree not to have any more children if their first baby was a boy rather than a girl. The imbalance was, again, more pronounced in rural areas.

Data on one-child certificate holders from the in-depth survey have not yet been analyzed but preliminary results indicate an increasing acceptance of the one-child norm. In Shanghai, for instance, four-fifths of sampled women had borne only one child, compared with less than half the respondents in Shaanxi and Hebei. The researchers attribute these differences to variations in infant mortality rates among the three areas — from 19 deaths per 1000 births in Shanghai to 35 per 1000 in the other two provinces. (It is common for rural couples to have several children in the fear that one or more will die.)

Varying infant mortality reflects divergent social and health conditions: in Shanghai, for example, the large majority of deliveries take place in hospitals, whereas in the more isolated provinces most of the births occur at home. Thus, researchers note that if the one-child family policy is to succeed in rural areas, health conditions there must be substantially improved.

CONVINCING THE PEASANTS

In spite of its record to date, China's population policy still faces numerous challenges, including the need to improve family planning acceptance in rural areas. Many Chinese express doubt as to whether the policy's success in the countryside will ever match that of the metropolitan areas. The "responsibility system", which permits the sale of surplus produce on the open market, has already greatly enhanced the welfare of rural peasants, enabling some to provide for several children independently. They may well be willing, therefore, to forego some of the public benefits offered to one-child families.

Another challenge is the reversal of public prejudice in favour of sons so that couples will be content with only one child, whether male or female. This radical change in sex preference has already begun, and there is little concrete evidence of female infanticide or neglect.

One researcher noted that ancient proverbs in praise of girls are being revived. One, for example, compares boys to jackets, which are meant primarily for appearance and are easily removed. Girls, on the other hand, are like undershirts: their value is less obvious but they are worn close to the heart!

It will be fascinating to follow the future course of demographic trends in China, the world's most populous nation. Indeed, if current enthusiasm for fertility surveys continues, the resulting documentation will be rich and plentiful. □

Carol Vlassoff is Associate Director, Population and Development Research Program, in IDRC's Social Sciences Division.



Photo: Carol Vlassoff

COMMENTARY

COLLECTIVE WISDOM PARTICIPATORY RESEARCH AND CANADA'S NATIVE PEOPLE

Many development problems now confronting Third World nations have been spawned by the culture clash between colonizer and colonized. To a large extent, Canada's Native people, some 3 percent of the country's population, share that historic predicament. In this commentary, Marlene Brant Castellano, a Mohawk Indian and professor of Native studies at Trent University in Peterborough, Canada, describes the process and development-related benefits of "participatory research". Her example is that of the efforts of Canada's Native people to resolve the thorny issue of family and child welfare.

By MARLENE BRANT CASTELLANO

Ordinary people are capable of generating the knowledge necessary to guide their action.' This is a basic assumption underlying the practice of participatory research.

When the principle is enunciated in the research community a host of questions is immediately raised: If the statement is true, why is community knowledge not being applied more effectively to resolve critical problems? How does this axiom fit with the passivity we encounter in trying to promote development? Is scientific expertise unnecessary, then, in community problem-solving? How can researchers with a scientific knowledge base involve themselves in participatory research?

Although Canadian experience cannot be directly transferred to the context of developing countries, there may be enough similarities between Third World environments and Native communities in Canada for a useful discussion of these questions.

Probably the most vigorous efforts to effect social change in Canadian Native communities are those focused on family and child welfare. In very practical ways the knowledge and resources of the community have been

mobilized to attack a problem that had reached catastrophic proportions.

REMOVAL OF CHILDREN

In the 1960s health and social service professionals identified a widespread crisis in Native family life. Alarming numbers of parents were evidently failing to provide adequate care and supervision of their children. The response of government-supported social agencies was to remove the children from the circumstances of neglect and place them in foster care outside the communities, where they typically remained until the age of 16 or 18.

Social science researchers interested in this phenomenon noted that child neglect, with subsequent child removal, was occurring most frequently in communities where the shift away from a hunting and fishing lifestyle had taken place without complementary integration into an urban-oriented, industrial economy. Mental health clinicians observed that the deficiencies in parenting were occurring in families where the parents themselves had been deprived of adequate socialization because of confinement in residential schools throughout their formative



years, a practice that had largely been abandoned by the 1970s.

There were also studies documenting a correlation between foster care experience and conflict with the law, suicide, and other symptoms of mental distress in native youth and young adults. Although these research findings gave a partial explanation of what was happening, they did not result in action to institute new economic strategies or to stem the tide of further family disruption.

It was the initiative of Native political leaders that established child welfare reform as a national Native priority in 1983. This was the culmination of a participatory research process, carried out primarily in an oral mode, which began in local communities and gathered momentum over several years.

Local actions had protested adoption practices that permanently removed Native children from tribal membership. Influential chiefs, who had themselves lost children or other relatives to adoption, foster care, and suicide, were outspoken in their criticism. A film and study reports on the issue were produced and widely circulated. Nationwide hearings of a federal government committee on Native self-government provided a

forum in which the breadth and depth of concern became evident.

By 1983 there was a consensus among Native people and assent in government agencies that wholesale removal of Native children from their families and communities had to stop, and that family support measures had to be initiated. Local leaders demanded that social agency personnel be accountable to local authorities. Alternative care facilities in the community began to be identified. Health education, carried out by health aides recruited from the community and aimed particularly at young, often single parents, was promoted. Study circles and workshops on nutrition, family violence, alcohol abuse, and parent-child communication were convened. Competent parents and elders knowledgeable about traditions of childrearing were sought out as resources.

At present, local communities in many districts are banding together to establish family and child service agencies. These agencies assume legal responsibility for protecting the welfare of children, which, native people declare, has always been their right and their responsibility, even though it was taken over for a time by outsiders.

The question posed earlier was: If community knowledge is potentially effective, why is it not applied? The crisis in Native child welfare overtaxed the community's capacity to respond because of the rapidity of social and economic change and because the normal channel for transmitting and adapting knowledge from generation to generation was disrupted by the residential school experience. The surrounding society pre-empted the community's right to work out its own solution and, in attempting to help, compounded the problem. The healing process is now being carried forward on the initiative of Native people, with the determination that their own knowledge will not again be overridden by outside expertise.

Why did the Native community adopt a passive stance for so long? Under the Indian Act and the neocolonial administration which the Act imposed, Native people lost the power

to make decisions affecting their communities. They were conditioned to believe that they were backward and to accept the judgments of administrators, clergy, teachers, doctors, and police, almost all of whom were educated representatives of mainstream Canadian society. It is significant that the Native community mobilized initially not around the child welfare issue, but around a threat from the Canadian government to terminate historic treaties and the unique system of collective land tenure which they

ties and the path of action; scientific knowledge was instrumental in carrying out the action.

EXPANDING THE KNOWLEDGE POOL

Discussion of the final question — how researchers with a scientific knowledge base can involve themselves in participatory research — requires some clarification of what we mean by 'research'. Suspicion is sometimes voiced that participatory research is actually community development under an

but also information passed on from others and judged by the participant to be significant.

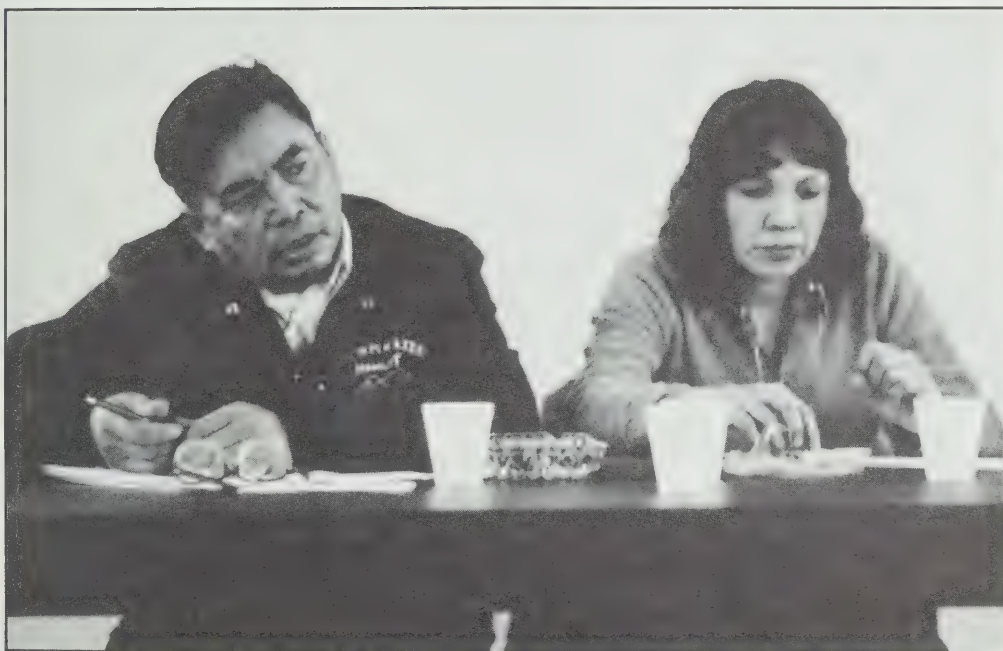
Participatory research requires a collective, with a common means of communicating, as well as agreed-upon rules for selecting or rejecting information, interpretation, and opinion as a basis for decision-making. Although participatory research could be carried out within powerful institutions, it has been articulated in work with poor and powerless constituencies, among those people who

organizational strategies employed in similar circumstances elsewhere. While there is always the danger that the participatory researcher will fall into the role of expert director, the principle adhered to is that the knowledge and authority of the people are paramount.

From this discussion it should be evident that nothing precludes scientific researchers from participating as peers in a community's participatory research. But they must be willing to submit their experience to the collective process of deciding what is valid and useful as the basis for action. If they wish to assume the role of catalysts, they would do well to acquire skills to facilitate group formation, reflection, and analysis. With the proviso that the community which creates knowledge has a right to prevent dissemination of information contrary to its interests, participatory researchers can and do draw inferences, postulate theories, publish reports of their activities, and engage in scholarly exchange, pursuing goals that may be quite separate from the development goals of the host community.

The example of child and family welfare illustrates the potential complementarity of conventional and participatory research. Social research, in which Native people were objects of investigation, helped to establish, within mainstream Canadian society, the legitimacy of Native aspirations articulated through a participatory research process.

Clearly not all research questions are amenable to exploration by participatory methods. Nor is participatory research a panacea for the multiple problems of poverty, political marginality, and social breakdown which plague Canadian Native people as well as numerous communities in the Third World. Evidence is accumulating, however, that in identifying access points for community change, setting priorities for development, integrating interventions with various sectors of community life, and applying results of laboratory and survey research, participatory methods have an important contribution to make in research aimed at development. □



Participatory research has been articulated mainly in work with poor and powerless constituencies.

now enjoy and consider fundamental to their survival as a people. Activism to retain their children was a natural spin-off because, by tradition, the land belongs to the children not yet born. The question of whether popular knowledge excludes scientific knowledge derives from the erroneous assumption that the former functions as a closed system. In lobbying for child welfare reform, Native people made use of social science research to support their arguments. They became informed about policy-making processes in order to formulate credible alternatives. And they heeded medical and statistical evidence about the incidence of fetal alcohol syndrome and made maternal alcohol abuse a target for health education efforts. The knowledge of the people determined the priori-

assumed name.

My generic definition of research is: a systematic effort to expand the pool of knowledge accessible to society. The systematic effort fundamental to the participatory research method is collective engagement in a rhythm of action-reflection, from which knowledge is created. Action without reflection is activism. Reflection without action is intellectualism. The collective analysis of experience serves to distinguish between personal perceptions, which are valid for the individual but not necessarily for society, and potentially reliable knowledge, which can be used as a basis for action, which in turn generates experience for further reflection. The experience processed in reflection includes not only those things known firsthand

have historically been possessed of the authority to produce socially legitimate knowledge.

THE NEED TO ORGANIZE

Those who have lived together under oppressive circumstances do not necessarily see themselves as a collective. Nor do they always have available the language to communicate their experience. Organizational structures may need to be created particularly if action is to be directed at changing conditions outside the collective.

Participatory researchers frequently act as catalysts to stimulate awareness of common interests, to introduce communication techniques that facilitate analysis, and to provide information on

Arms vs development

For many Third World countries, the greatest threat to national security comes less from invading armies than from expanding deserts or eroding topsoil. According to a report released by the Worldwatch Institute, a Washington-based research group, a choice must be made between continued militarization and an attempt to deal with growing national deficits and deteriorating environments.

"Throughout most of the postwar period, an expanding economy permitted the world to have both more guns and more butter. For many countries, however, this age has come to an end. As pressures on natural systems and resources build, as the sustainable yield thresholds of local biological support systems are breached, and as oil reserves are depleted, governments can no longer both boost expenditures on armaments and deal effectively with the forces that are undermining their economies."

The driving force behind the militarization of the world economy is the ideological conflict between the Soviet Union and the United States and their respective allies, says Lester R. Brown, director of the project which produced *State of the World 1986*. The report is the third in a series of annual assessments from Worldwatch.

"The U.S.-Soviet arms race has sapped the energies and resources of both countries, and the entire world is paying the price," he writes.

"Besides the squandering of resources, global militarization has contributed to the neglect of other pressing issues, such as the environmental deterioration and growing Third World debt."

In 1985, global military expenditures reached \$940 billion. This is more than the combined gross national products of China, India, and the African countries located south of the Sahara. And yet the number of people who lost their lives in the African

famines in 1984 and 1985 was greater than that resulting from any conflict since the Second World War.

According to the report, governments should concentrate on more pressing dangers such as oil depletion, soil erosion, land degradation, shrinking forests, deteriorating grasslands, and climate alteration.

The report concludes that the only viable development strategy is one based on environmental criteria, not military ones.

Rosanna Tamburri, Carleton University School of Journalism, Ottawa.

Kenya finds mercury in cosmetics

Disturbing evidence of mercury in beauty soaps and skin-lightening creams has been found in a wide range of brand-name goods sold in Kenya, despite recent denials by some manufacturers.

A report by two members of the chemistry department at Nairobi University found as much as 4.92 parts per million in one of the most popular cosmetic bleaches, a level considered far too high.

The report, by Professor Shem O Wandiga and Isaac J. Ogangu, points out that tests on samples of head hair showed mercury levels among people using skin-lightening creams ranged from 2 to 1000 times that of people who never use such creams.

Deaths in Kenya from mercury poisoning are known to have occurred among "unsophisticated users of toiletries", they say.

Mercury absorbed into the body is believed by some scientists to concentrate in the brain, causing oxidation which can damage the central nervous system, and the kidneys. Poisoning from the use of skin-lightening cream is usually indicated by a skin rash, followed by blistering, and inflammation of the mouth and throat.

The report says that not one of the manufacturers

named mercury as an active ingredient in their products. In Kenya, the Pharmacy and Poison Act only requires the registration of ointment with 15 percent mercury. Today it is known that "the safest level of mercury for human consumption is none at all." The report urges that the law be changed to keep up with the scientific knowledge, and that drug manufacturers pay stricter adherence to proper labelling practices.

Paul Amina and Andrew Chetley, Gemini News Service.

VITAL learning in Thailand

Students at a university in Thailand will be using a Canadian computerized learning tool when they return to school in September.

The 400 000 students of the Sukhothai Thammathirat Open University study at 85 learning centres spread throughout the country and for the past six years have relied on television, radio, and print materials for contact with their teachers. However, in three subjects studied by more than 20 000 students, the failure rate has been over 80 percent. University authorities felt, therefore, that a new instructional system was needed.

The Versatile Interactive Training and Learning System (VITAL) was developed by the University of Guelph in Canada. Its value lies in its ease of operation and low cost. Teachers create their own reference or self-test instructional modules from which the students

obtain immediate feedback. VITAL provides statistics to the instructor on student and class progress and features full colour graphics as well as text.

The University of Guelph is now marketing VITAL worldwide.

For more information, contact the University of Guelph's Office for Educational Practice, Guelph, Ontario, Canada N1G 2W1.

A new solidarity in Southern Africa

The Southern African Development Coordination Committee, launched five years ago by nine African countries to promote regional development, is bearing fruit. A considerable number of projects have been supported, particularly in the area of transportation and communications.

The largest project undertaken to date, costing US \$92 million, will provide Malawi with access to the port of Nacala, in Mozambique, thanks to the restoration of a railway line. Thousands of kilometres of roads and railway lines have also been built or renovated in countries which are members of the Committee (Angola, Botswana, Lesotho, Malawi, Mozambique, Swaziland, Tanzania, Zambia, and Zimbabwe).

In a strong position because of the successes which have marked its first five years, SADCC now intends to centre its efforts on agricultural projects, including the important food safety program in Zimbabwe.

Excerpt from Cooperation sud.



Better infrastructure in Zimbabwe will increase food security.

Photo: Rowan Shirke

Award-winning rice mill

Shortly before Reports went to press, the following telex was received from IDRC's Singapore office:

For your information, the rice mill developed under the IDRC-assisted project, Village-Level Rice Milling (Thailand), under Ms Sriwai, Division of Agricultural Engineering, Thailand Royal Department of Agriculture, won the best agricultural machinery invention award from the Ministry of Industry and Ministry of Agriculture. The same mill has been tested in Indonesia by the directorate of food crops and is considered superior to the locally modified iron huller. The mill has also been selected by the World Food Programme (WFP/UNHCR) and a number of units have been commercially manufactured and exported to Africa.

An article on this innovation will appear in an upcoming issue of Reports.

Test-tube dates

Dates are an essential commodity in many parts of the world, particularly the Middle East. They are a staple in the diets of millions of people worldwide. And an estimated 200 000 families depend solely on the income derived from selling dates.

Now a process developed by a 37-year-old geneticist, Dr Dil Ram Sharma of Haryana Agricultural University in the Indian state of Haryana, could revolutionize the production of date palms.

Sharma, working on specimens of the Khadravi variety of date palm tree which he found growing around the campus, has discovered a way of raising date palms in test tubes using tissue culture.

Besides delivering a tree of sure variety and sex, Sharma's process could cut the cost of raising a single plant to a fraction of the normal cost (from \$1000 to \$1). Most of the savings are the result of Sharma's ability to bypass the uncertainties of traditional date raising.

Unfortunately, it is not possible to use the same method for other varieties of date. Explains Sharma: "The method of plant regeneration will have to be standardized for each variety growing in a particular agroclimatology zone." With the potential savings made evident by Sharma's success, however, it is unlikely to be long before other researchers take the hint.

A.J. Singh, Gemini News Service.

A battle won in the war against malaria

In 1978, the Cape Verde Anti-Malaria Brigade rolled up its sleeves to attack health enemy number one: the vectors of malaria. Seven years later, according to a report in the April issue of the Togo-based French-language magazine *Famille et développement*, the first round has been won.

Thanks to an active policy of fighting and controlling the centres of infestation, today the Brigade can boast of having knocked out the enemy. Its combat tactic consisted of three phases, implemented simultaneously: distribution of medication to each person in the zones affected by malaria; spraying of insecticides in the mosquito-infested sectors and treatment of stagnant water to check the larvae in it; and biological warfare using a South American fish, *Gambusia affinis*, which is particularly fond of mosquito larvae.

In 1978, 857 cases of malaria were reported in the Cape Verde Islands. But the Brigade's plan of attack helped to gradually lower the number of cases and finally in 1983, there were no victims of the disease. Since then, those working in the struggle against malaria have been concentrating their efforts on consolidating gains, and the preventive measures remain in effect: spraying, monitoring of water basins, periodical blood sampling and analysis, and health control of foreigners coming from malaria zones.

From an article by Djib Diédhou, a journalist with *Famille et développement*.

NEW RELEASES

A Handle on Health: Promoting self-reliance in handpump technology

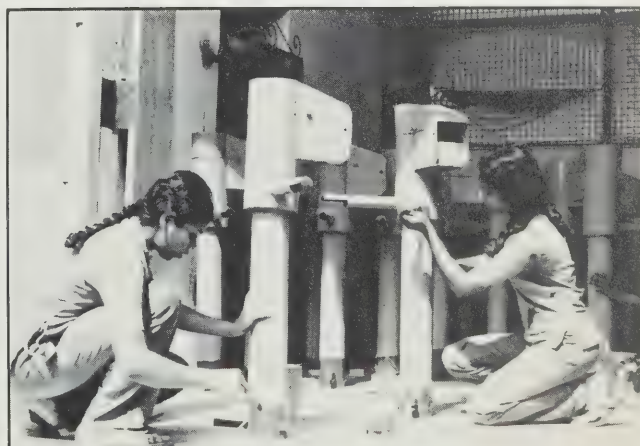
A 27-minute colour film produced by IDRC's Communications Division. English and French copies available as 16mm prints or as video cassettes in NTSC, PAL, or SECAM signal systems (U-matic, VHS, or Betamax formats). Released May 1986.

Thousands of people in the developing world die each day for lack of access to clean water and proper sanitation. Women and children spend hours and waste energy each day in back-breaking labour, bringing home water that is often contaminated.

A Handle on Health shows how this burden can be lifted by actively involving the community in a new approach to the delivery of safe water. The projects featured in the film — in Ethiopia, Malaysia, the Philippines, Sri Lanka, and Thailand — demonstrate how simple, durable hand-pumps can be designed, tested, and manufactured in developing countries with low-cost materials, providing employment opportunities and saving scarce foreign exchange. The film also shows how women, the Third World's primary drawers of water, are helping to ensure a safe, uninterrupted supply by taking control of water delivery, maintaining, and even manufacturing their own handpumps.

With our own hands — Research for Third World Development: Canada's Contribution through the International Development Research Centre 1970-85. Published June 1986, IDRC-246e, 206 pages.

This book is divided into three parts: a critical introduction, an historical look at research in the Third World, and an examination of 10 research projects in which IDRC has participated. The projects are: the jiko stove in Kenya, animal production systems in Central America, primary education in Egypt, hygiene in rural Senegal, aquaculture in India, oral rehydration in the Philippines, Jamaica's national information system, cropping systems in Indonesia, firewood and construction wood in Malawi, and potato storage in Peru. For more information, see summary and review on pages 20 and 21.



Assembling handpumps in Sri Lanka.

In addition to IDRC *Reports*, the Centre publishes a wide range of material on development issues. These include scientific monographs, reports, and bibliographies on specific IDRC research areas, as well as general interest literature. These publications represent research interests and activities supported by IDRC in agriculture, food and nutrition, population, health, education, information, and social sciences. Films describing the Centre and some of the areas of development research are also available. A catalogue of current material, publications or films, is available from the nearest IDRC regional office or from IDRC in Ottawa (see page 3 for complete addresses.)

Publications may be ordered from the IDRC sales agents listed here.

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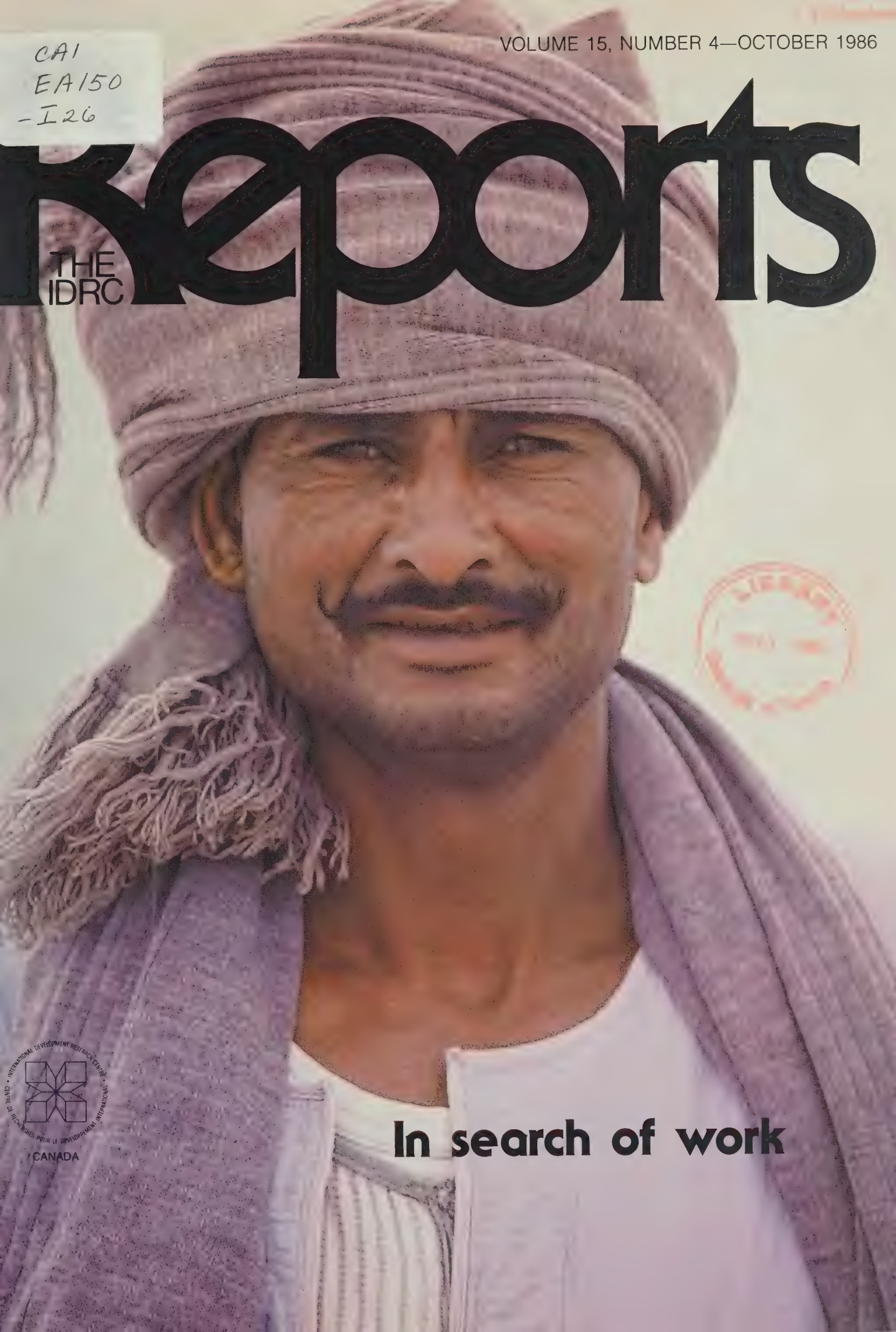
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VOLUME 15, NUMBER 4—OCTOBER 1986

reports

THE
IDRC



In search of work

LETTERS

An asset in the classroom

As a member of the Atelier Sud-Nord (South-North Workshop), which produces educational materials for secondary school students, I feel it would be useful if teachers and youth were more familiar with your magazine. The publication is well suited for use in the classroom, and is an excellent tool for introducing people to the problems of international development. Several of your articles have been reprinted in our Guide to Educational Resources for International Understanding which is aimed at secondary school teachers.

We eagerly await upcoming issues of the magazine.

François Carrier
Atelier Sud-Nord
Montreal, Canada

Letters from readers are welcomed and should be addressed to:
The Editors
The IDRC Reports
P.O. Box 8500
Ottawa, Canada K1G 3H9

Dairy cooperatives

The article "Lessons from India" in the January 1986 edition of *The IDRC Reports*, written by David Creighton, is so interesting that I decided to contact you for more information. I am specially interested in the functioning and success of dairy cooperatives. The most cited case is

2

that of "Operation Flood". As Mr Creighton wrote, there is a project in India co-financed by IDRC, dealing with dairy problems, too.

Can you provide information on the design or first findings of that joint University of Delhi/McGill University (Montreal) project? Secondly, is it possible to obtain the papers or proceeding of the 1983 symposium "Cooperatives and Rural Development"?

Dr Peter Hrubesch
Deutsches Institut
Für Wirtschaftsforschung
West Berlin, West Germany

For more information on the rural cooperatives project, contact:

Dr B.S. Baviskar
Department of Sociology
Delhi School of Economics
University of Delhi
New Delhi 110007
India

The papers from the symposium are to be published later this year by Oxford Press in New Delhi. Contact:

Ravi Dayal
General Manager
Oxford University Press
P.O. #43
YMCA Library Building
Jai Singh Road
New Delhi 110001
India

The Editors

Error in protein percentage

We have received copies of the April 1986 edition which contains an article by Robert Charbonneau on IDRC-sponsored potato processing research at the International Potato Center. Unfortunately, there has been

a mistake in the article: the protein content of the M6 product calculated from food tables is 10.6 percent and not 86 percent as stated. The 86 percent is a score to indicate the high quality and efficiency of the protein contained in the potato-based food mix.

Robert Booth
Leader, Post-harvest
technology
International Potato Center
Lima, Peru

A handle on health

The April 1986 edition of *The IDRC Reports* included an article by Neill McKee on women and water. Mention was made that a film on handpump technology had just been completed.

We would appreciate very much receiving information on how to obtain a copy of this film. We wish to use it in the village drinking water supply activities in which we are engaged in Southern Darfur (Western Sudan).

R.L.M. Verhoeven
Dept. of International
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A Handle on Health may be borrowed in 16mm film format from: IDRC offices (addresses listed on page 3); some Canadian diplomatic missions in developing countries and those in France and Britain; and National Film Board libraries in Canada. It is also available for sale in 16mm film format and in U-matic, VHS, or Betamax video format (NTSC, PAL, or SECAM signal system). Write to the nearest IDRC office for more information.

The Editors

Mosquitoes and TV

I read with interest the commentary by Iain McLellan on page 23 of the April 1986 edition of *The IDRC Reports*, based on his "Television for

Development: The African Experience", published by IDRC (MR-121e).

Unfortunately I have not read McLellan's report (might a copy still be available?) but I am wondering whether an important aspect of TV viewing in developing countries has been mentioned. In a number of countries in Africa and in Central and South America I have noticed that TV sets available for public viewing are extremely popular; showing is normally at night and viewing may go on until midnight. In many tropical or subtropical countries, the villagers are exposed to increased risk of mosquito bites; and therefore increased risk of malaria infections where this disease is still a serious problem.

I cannot provide firm figures for the increased level of infections, but I and my assistants can attest to the biting of the viewers by anopheline mosquitoes, inasmuch as we have sometimes obtained permission of village leaders to make collections of mosquitoes attracted to the viewers.

In countries where the mosquito-conscious health educators have included television as one of the media for their messages, it is ironic indeed if those viewing a TV "spot" on how to avoid malaria are sitting intently viewing the TV set in the dark while anopheline mosquitoes are relishing the opportunity to transmit malaria parasites to the relaxed villagers!

Donald J. Pletsch, Ph.D.
Vector Control, Malaria
Gainesville, Florida

We'll send you a copy of McLellan's report. A program officer working in IDRC's tropical diseases program suggests insect repellent as a way to minimize the risks of evening TV viewing. In any event, groups of people will attract mosquitoes in the evening, whether they are watching the latest anti-malaria program on TV or simply sitting around talking.

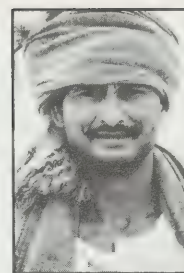
The Editors

Reports

THE IDRC

Front cover: Many Arabs like this Egyptian worker must leave home and country in search of work. See pages 4-11 for articles on labour migration.

Photo: Dave Barbour / CIDA



CONTENTS

Letters		2
In search of work	Melba Gomes introduces the theme of this issue by outlining the human dimensions of world labour migration, especially as it affects women.	4
Gaza's labour trap	In the Gaza Strip, so economically dependent on Israel, commuting workers are stuck in low-paying jobs, with few chances for advancement. Garfield H. Horn reports.	5
Waves of workers	A little history . . . Nader Fergany retraces the role of migrant workers in the Middle East oil boom.	6
Keeping house away from home	Denis Marchand records the hopes and struggles of over-qualified Filipinas working at menial jobs in Hong Kong.	8
Survival strategies	In Latin America, flagging economies push migrant workers into finding new sources of income. The illicit coca trade is one. By Andrea Doucet.	10
A blind man's vision	An innovative Caribbean group helps sighted people protect their vision and blind people find jobs. By Frank Campbell.	12
Lucrative latrines	The Vietnamese latrine that doesn't waste waste. Steve Hunt reports on its use in a Guatemalan village.	13

Bamboo: the towering grass	This poor man's timber, probably the most widely used plant in Asia, still hides a mystery. A photo feature by Denis Sing and text by Neill McKee.	14
Pioneers of the Amazon	Peruvian scientists advise subsistence farmers in their fight against deteriorating soils. A report by Robert Charbonneau.	16
Fencing off fish	Raising fish in pens and cages has great potential, especially for entrepreneurs with little capital. By Howard Powles.	18
The worm within	Barray Amana reports on Togo's battle against dracunculosis, caused by the parasitic guinea worm.	20
No profit, no medicine	Large pharmaceutical companies show little enthusiasm for markets in the developing countries. By Raymond Lemieux.	21
Beyond smallpox	Vaccinia, which helped the WHO eradicate smallpox, is on its way to becoming a multipurpose vaccine. Jean-Marc Fleury explains.	22
A researcher's best friend	IDRC's "Development Data Bases" service provides researchers with hard-to-get information about the Third World. By Gerry Toomey.	24
Briefs	News and trends in international development.	26
New releases	Publications from IDRC.	27

IDRC

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IN SEARCH OF WORK

Labour migration—the movement of people for economic survival or advancement—is an age-old phenomenon. Today one can distinguish between three basic types: “brain drain”, the exodus of highly trained and skilled workers from the developing world to the industrialized world where they can command better salaries and more prestigious positions; classic “rural–urban migration”, which occurs when subsistence farming is no longer enough to provide for families; and “international contract labour migration”, usually associated with the middle stage of industrialization when a host country’s economy is expanding and needs a large, relatively unskilled labour force to build a national infrastructure.

The major international movements of labour today are concentrated in the Andean region of South America, West Africa, Southern Africa, the Middle East, and parts of Asia. This issue of The IDRC Reports examines the causes of migration and the obstacles that migrants face in several developing countries.

By MELBA GOMES

Imagine a situation where, as a result of death, desertion, migration, or the disability of working-age males, and because of deteriorating economic circumstances, a family’s only able-bodied worker is a woman.

She is landless, has young children, and lives in a developing country. How does this woman—who is usually responsible for the work of food processing, fuel and water collection, child-bearing, nutrition and child care—take on the added responsibility of full-time paid work? More often than not she migrates to secure an income, taking her children with her if she can.

In Nicaragua, largely as a result of the war in which many able-bodied men have been drafted into the army or have been killed, the number of low-income, female-headed households is on the increase. During the harvest season, women with young children migrate long distances to coffee and cotton plantations in search of work. The hours are extremely long, the work is physically demanding, and there is no job security.

Older children, particularly girls, begin to assume major responsibilities for children only a few years younger. In extreme cases, children are left alone. In some instances, women are forced to take their children to the fields during the peak harvest periods, or to leave them untended at the edge of the farm. In other cases, they carry them on their backs while they move up and down the rows of coffee or cotton bushes, bending down to harvest the crops.

What are the economic and health costs to a woman burdened with an infant while she labours in the field, or when she is obliged to divide her attention between the task at hand and the children at her side?

In Sri Lanka, the nature of migration is different. Certain industries deliberately recruit young rural women as factory workers and establish dormitories for them. But the massive migration of young Moslem women to lucrative employment in the Middle East, Singapore, and Hong Kong, despite the Islamic practice of purdah by which women are removed from public view,

is also of great significance.

Islamic culture generally dictates a highly secluded status for women. Females are not expected to move from one place to another without proper escort, particularly if they are

in cash with their husbands at the end of the contract. The income is spent on immediate needs rather than invested in a way that will ensure the long-term economic security of the family. The evidence begs the question of whether migration results in any long-term improvement in the well-being of the migrant or the migrant’s family.

These are only two examples of the many human dimensions of migration—the movement of labour in an effort to cope with change. The change may result from civil war or political conflict, as in Nicaragua, the Middle East, Afghanistan, Vietnam, and South Africa. But it is more commonly brought about by internal economic and demographic change which forces individuals—traditionally males, but increasingly females—to seek economic refuge wherever possible.

In this context, IDRC has funded a number of studies looking at the causes, nature, and consequences of national and international migration. Originally these studies



Socializing after Sunday mass. In need of money, many Filipinas have migrated to Hong Kong to work as housekeepers. See article on page 8.

young and unmarried. Young married women usually live in their husband’s home, visiting their own parents’ home only occasionally.

In these circumstances, it would be reasonable to expect minimal mobility of women except in cases of utter destitution and lack of family support. Why then do many Moslem women, often married, migrate abroad for work? What are the consequences of this migration? Researchers are looking for the answers to these and other questions.

Emerging evidence seems to indicate that, because these women do not know how to manage money, they deposit their earnings

focused on Asian labour migration to the Middle East where there are now some 3.7 million Asian contract workers. More recently, however, the scope of IDRC-funded research has been widened considerably to permit more comprehensive assessments of what these spatial movements mean for the host countries and the sending areas. The study of migration, of its linkages to the societal changes that provoke it, and of its consequences, provides a useful perspective on a variety of issues related to development. □

Melba Gomes is a Program Officer in the Population and Development Research Program of IDRC’s Social Sciences Division.

GAZA'S LABOUR TRAP

By GARFIELD H. HORN

The Gaza Strip is an island in a sea of indifference and hostility. It seems to have been forgotten in the peace process, both by the West and by the Arabs. It is isolated by geography and politics, cut off from the rest of the Palestinian people and the Arab states by the might of Israel and by the course of history.

Since the "naksa", the occupation by Israel in the 1967 war, Gaza has increasingly become, in the American expression, a "bedroom community" for the Jewish state—simply a place for employees of Israeli businesses to live. The economy of Gaza has become more and more dependent on that of Israel, as the number of income-producing and wage-paying Palestinian industries decreases.

Nearly half of Gaza's labour force of 90 000 works in Israel.

Nearly half of Gaza's labour force of 90 000 works in Israel. The rest work in a few Israeli-owned businesses in Gaza and many small Palestinian-owned businesses. What this means is that, even if an accord were to be reached with Israel and Palestinian independence realized, the Gaza Strip would have lost most of its capacity to be independent.

Gaza has a population of 600 000 (expected to reach one million by the year 2000) and one of the highest population densities in the world. The living conditions of Palestinians in the Gaza are probably the worst of all displaced Palestinians. This situation needs to be improved and the Palestinians must be able to determine their own future, but first more knowledge is required.

Much has been written about the overall social and economic patterns in Gaza, but little is known of the labour motivations and perceptions of the individual families. That is why the Arab Study Center, a Jerusalem-based Palestinian research foundation, undertook a study funded by IDRC. Headed by Dr Faisal Abdul-Qadar Hussein, the study sought to determine which households were dependent on work in Israel and abroad, which derived their income from inside the Gaza, and which economic and social factors were behind the working and living decisions made by household members. The study consisted of intensive interviews with 143 families in Raffa, a city considered representative of the Gaza population as a whole.

What the study found is that the labour force is divided into two fairly distinct groups, fitting into what economists call the "dual labour market" model. Those in the first

group have jobs that offer good pay, benefits, opportunity for advancement, and security. Those in the second group, into which most of the Gaza labour force fits, have jobs with none of these qualities. Most of the first group is made up of families living in the Gaza area before the 1948 war, while the second group consists mainly of refugee and Bedouin families.

The study showed that these labour patterns tend to reinforce themselves. The workers in the second group, having little opportunity for meaningful or steady work now or in the future, tend to resign themselves to their lot in life and not seek higher education. Those in the first group, being better educated, are likely to seek employment in Israel or abroad where the pay and security are better. (According to 1983 figures, about one-third of Gaza's gross domestic income came from remittances of workers abroad.)

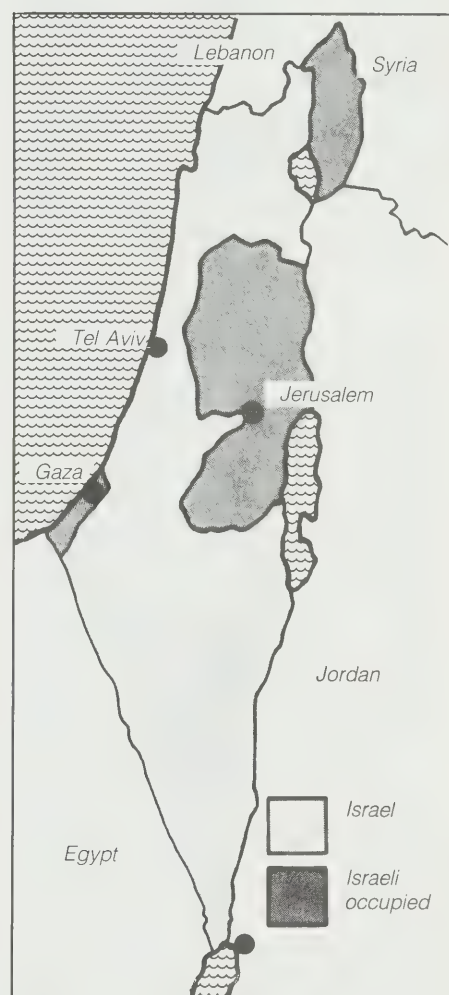
The lot of the workers commuting into Israel every day—they are not allowed to spend the night—is not good. Three-quarters of those sampled do not have health or retirement benefits, and nearly one-third reported spending 20 hours or more a week commuting to and from work. Still, the jobs are better than in Gaza.

OPPORTUNITY FOR ADVANCEMENT

The study also pointed out a changing education pattern in Raffa households. Whereas only 4 percent of heads of household that were interviewed had university degrees, 11 percent of all family members had degrees, suggesting that the next generation is better educated and thus more likely to work outside Gaza. Recent economic developments will, however, have a serious effect on their opportunities to do so. Israel itself is having economic difficulties and may have to reduce its work force. And the recent drop in oil prices means that many of the 25 000 Gaza residents working in the oil-producing states will be sent home and forced to seek menial jobs within the second group.

Within Gaza, there is little opportunity to advance to the first labour group, even if a worker has a capital base. The pattern of Israeli intrusion on the land, licencing and regulatory restrictions, the cutting off of export markets, and the flooding of Israeli imports into Gaza have practically eliminated all opportunities for Palestinians to establish large, modern employment-generating industries. And Gaza residents have little chance to form labour and commercial organizations because of Israeli restrictions.

The new generation, the study points out, has low expectations and poor chances for advancement in Gaza. Most of the respon-



Source : Gemini News Service

dents interviewed cited family and personal connections as the main way to gain access to jobs rather than training and educational factors. This will reinforce the existing dual labour structure.

"The Gaza is fully integrated into the Israeli economy. It is a major market for Israeli products. It is very unlikely that this pattern will change," says Dr Jan Abu-Shakrah of the Arab Study Center.

It must be asked whether this is an advantage to Israel in the long term. The population of Gaza cannot be maintained indefinitely in second-order jobs. Gaza could become more than just a thorn in Israel's side if violence, bred through frustration, were to erupt. A combination of inside and outside forces must be used to improve life in Gaza, and this is what the Arab Study Center hopes to achieve. □

Garfield H. Horn is the editor of Cairo Today Magazine.

WAVES OF WORKERS

THE ARAB WORLD'S EXPERIENCE

By NADER FERGANY

Migration across the different parts of the Arab world is an old phenomenon. As early as the period when Islam was spreading, an extensive human movement swept the Middle East, greatly enhancing the unity of the Arab nation through the intermixture of people sharing a common language and creed.

This free movement was eventually restricted by the fragmentation of the Arab states under colonial rule at the end of the last century. In the 20th century, technical aid began to be sent from the advanced to the less advanced states, especially in the fields of health and education. These technical missions eventually formed the basis of the public service in the Gulf States.

With the expansion of the oil industry in some Arab states in the 1950s, demand for labour grew faster than local supply. Consequently, the oil industry was initiated by foreign expertise, with the managerial and technical positions being filled by Europeans and Americans. In some cases, foreign companies deliberately sought foreign labour.

The rise in oil prices created a great leap in revenues for the oil-producing Arab states, especially Algeria, the Emirates, Iraq, Kuwait, Libya, Qatar, and Saudi Arabia. The figures rose from US\$8 billion in 1972 to \$57 billion in 1975, and to \$205 billion in 1980. During the same period, other Arab states and most Third World countries were experiencing severe economic problems and becoming indebted to the industrialized countries.

In the second half of the 1970s, the continued expansion of Arab wealth required the establishment of a huge institutional structure and the importation of a labour force of diverse skills and standards. An economic surplus, a shortage of indigenous workers, and a strong demand for labour all combined to raise wages tremendously, especially when compared with those in other Arab states, Third World countries, and even the industrial countries which were undergoing an economic recession. Consequently, a labour force willing to move to the oil countries grew quickly in the rest of the world, in spite of the difficult living conditions in Arab oil countries.

IMPORTERS AND EXPORTERS

The Arab countries can be divided into two groups with respect to labour migration. One is the recipient of a large imported labour force (in order of quantity of imported labour): Saudi Arabia, Iraq, Libya, The Emirates, Kuwait, Oman, Jordan, Bahrain, and Qatar. The other group includes those states exporting a sizeable proportion of their labour force (in order of quantity of exported labour): Egypt, Yemen, Jordan, Palestine, Democratic Yemen, Sudan, Tunisia, Syria, and Lebanon. Jordan falls into both categories.

It is impossible to estimate accurately the



The economic expansion of the Arab oil countries in the late 1970s attracted some six million expatriate workers to the region.

size of the migrant labour force, its characteristics, and its social impact because of the unavailability of data. It is, however, possible to present a *general* picture of its size, development, and distribution.

In the early 1970s, the number of migrant labourers did not exceed 750 000. The figure doubled in 1975 and by 1980 it probably exceeded six million. However, it is currently less than five million.

It is also estimated that the proportion of non-Arab labour, mostly Asian, has grown, from one-quarter of the migrant labour force in the mid-70s to one-third in the early 1980s.

FAMILIES ACCOMPANY WORKERS

But the magnitude of labour migration does not adequately describe the phenomenon in either the exporting or importing societies. Migrants' families may accompany them to the host country, and of course this has a major impact on both the exporting and importing countries. In general, then, the number of migrants to the host country exceeds the actual number of imported workers. The effects of this migration on the exporting countries extend beyond the families of the migrants to various segments of society, through such phenomena as shortages in skilled labour and rising prices.

For these reasons many researchers consider labour migration in the Arab oil states as one of the most important socioeconomic phenomena experienced by the Arab world in recent years—one that has integrated Arab states to an extent unprecedented in recent history.

The impact of labour migration is both positive and negative. The effects are so intertwined, however, that it becomes difficult

to assess the situation with precision, especially in the absence of accurate data and/or scientific research. In addition, some Arab oil states, especially small ones, have experienced an influx of non-Arab labour, whose impact is seen as negative.

FOREIGN EXCHANGE SHORTAGES ALLEVIATED

For the exporting country, a major benefit is the large inflow of oil remittances by migrants and their families. This is reflected positively at the individual economic level and in the reduction of national foreign exchange shortages. Remittances reached unprecedented values in the late 1970s but started to fall in the early 1980s.

On the other hand, the negative effects on the individual migrant include: an emphasis on consumption; undergoing hardships to get the chance to migrate; and alienation and discrimination in the host country. On the broader level of society, there is the shortage of skilled labour in the exporting country, its impact on wages, and the increased importation of goods for consumption, through the expenditure of remittances.

'TRAP OF REMITTANCES'

Some researchers have warned against the "trap of remittances", since this money has not ended up developing the productive capacity of the exporting country as much as it has increased inflation.

Consequently, it can be argued that labour migration has had a negative impact on some of the exporting states—a condition aggravated by the paucity of related policies. Some countries have even been so short-

sighted as to concentrate on the remittances, neglecting all other factors. Such countries have later had to face economic crises when the wave of migration started to subside, along with the remittances, in the mid-80s.

The impact of labour migration on the importing countries depends on the degree of reliance on imported labour. In Qatar and the Emirates, expatriate labour constitutes the majority of the labour force. In Bahrain, Iraq, and Saudi Arabia, it accounts for one third. The importing countries also differ with regard to the proportion of Arab labourers in the total labor force. Whereas in Iraq, Jordan, Kuwait, Libya, and Saudi Arabia, Arabs dominate the labour force, in Qatar, Bahrain, the Emirates, and Oman, non-Arabs dominate.

Iraq is unique among the Arab states in not enforcing any immigration, work, residence, or ownership restrictions on immigrating Arabs. For these reasons, it has drawn many Arab migrants, mostly from Egypt. The relatively large size of the indigenous labour force and the equality of other Arabs with Iraqis before the law have helped to prevent many of the negative consequences of labour migration.

In Jordan, labour immigration has partially replaced labour emigration to other oil countries.

ECONOMIC PROGRESS

The socioeconomic changes in the Arab oil countries have resulted in clearly noticeable rapid economic progress. All aspects of life have been greatly modernized (infrastructure, services, consumer goods) to the point that they approach the standards of the industrial Western societies. Such progress could not have been achieved without expatriate labour.

The labour-importing countries share three characteristics. First, their reliance on expatriate labour is extensive. Secondly, the socioeconomic conditions regulating the relationships between the natives and the immigrants end up dividing the society into segments that are unable to interact in a healthy way. Consequently, social cohesion

and productivity are low. The problem is aggravated by the diversity of cultural backgrounds and nationalities of the immigrants and by the predominance of males among migrant workers. The third characteristic is the problem of training indigenous workers. The ease with which labour can be imported, coupled with the policy of welfare states of providing ample opportunity for high-profit economic activities to natives, has greatly impeded the development of indigenous work forces to replace imported labour.

DECLINING LABOUR MIGRATION

The collapse of the world oil market has brought an end to the large oil revenues and luxurious consumptive patterns enjoyed by the Arab oil states in the past 10 years. Perhaps this situation is temporary. No one knows what the world oil market holds in store for the coming months. But the growing economic crises in many oil-exporting states, aggravated by military and political conflicts, have lowered the standards for imported labour, its wages, and qualifications. This trend is expected to continue, and even increase in intensity. Labour migration peaked during the second half of the 1970s, but has gradually slowed down since the early 1980s. It will eventually lead to a relative decline in the magnitude of labour migration to the Arab oil states, paralleled with a fall in oil revenues.

If this prediction turns out to be true, the recipient countries will have to cope with difficult economic conditions not previously experienced. This could be the right moment for these states to rechannel their economic activities and patterns of consumption, and recruit indigenous, trained personnel with the objective of maximizing national self-reliance and achieving a better future for their citizens.

The future of labour-exporting countries appears somewhat dimmer. They have become used to a steady source of income in the form of oil remittances from the labour migrants. Although this revenue has helped meet the needs of migrants and their families, it has often been used to finance imports mainly for consumption rather than to develop productivity.

Now exporting countries are faced with the problems of returning labour workers and falling remittances at a time when foreign debts are accumulating and the crisis of development remains unsolved. There seems to be no solution for these societies except to turn inwards in an effort to alter existing patterns of consumption and enhance local productivity via policies and measures based on social justice and equal distribution. Otherwise, many of the labour-exporting countries will undoubtedly undergo a period of severe social upheaval. □

PROS AND CONS OF 'PAI NOK'

"Pai Nok" is what northern Thai villagers call labour migration to the Middle East. Over 350 000 Thais, mainly male farmers, have "gone abroad" since 1975. Working on construction sites, and now increasingly in the service industry, they have managed to earn up to 10 times more in the oil-producing countries than they could at home.

But exporting manpower is not the same as exporting goods—the workers themselves have to invest in the process. An IDRC-supported study led by Dr Anchalee Singhanetra-Renard, from Chiang Mai University in Thailand, has shown that besides generating US \$450 million in remittances, international labour circulation can also lead to indebtedness, landlessness, and perhaps class differentiation.

When Thai workers first started migrating to the Middle East, many were reluctant to go. They had to be enticed by companies which arranged and paid for everything including one-month vacations and 5000 Baht (US \$200) bonuses. The high wages the workers earned meant "instant economic transformation" for their families. Two-storey concrete houses, painted bright orange or green, and electrical appliances were the visible signs of success.

By 1981, however, with over 25 000 Thais working in 10 Middle East countries, the recruitment process had been reversed. Workers were paying recruiters and their agents as much as US \$500 to be taken on.

In order to migrate many Thais had to borrow money, mainly from private sources with interest rates averaging an onerous 10 percent per month. At the same time, overseas wages fell by 50 to 66 percent, and today, just the arrangements for going abroad can cost up to US \$2000. Workers accept this because they expect to be compensated through overtime. However, unscrupulous recruitment agents, an over-supply of workers, and the fall in oil prices have endangered workers' chances of even getting to the Middle East.

The University of Chiang Mai's study shows that villagers have never been so deeply in debt—many have lost their land and have become squatters on the edge of villages. Recruitment agents have been killed by angry would-be workers and other "failed workers" have committed suicide. It has also been demonstrated that there is a growing educational gap between the children of "successful international workers" and the children of those who stayed at home.

Ania Wasilewski, Ottawa.



Uncertainties in the oil industry threaten the job security of workers such as this technician.

Dr Nader Fergany has taught at Cairo University and is now with the National Population Council of Egypt.

KEEPING HOUSE AWAY FROM HOME

FILIPINA WORKERS IN HONG KONG

By DENIS MARCHAND

"I didn't leave home because I wanted to, anything but. I simply needed money to keep my family alive," says Estella, a Filipina who worked for eight months in Brazil as a nurse, and for two years in Saudi Arabia and three years in Hong Kong as a housekeeper.

"The wages they pay me here in Hong Kong are almost four times as much as I got as a nurse in the Philippines. Back in Manila I earned \$90 a month and here they pay me \$300 as a maid to do all kinds of work. Isn't a difference like that worth the journey? Because of it I've managed to pay for my daughter's medical studies, for the education of my five brothers and sisters, and for my father's hospitalization for heart trouble.

"Now, at last, I have a chance to think of myself a little. My financial responsibilities towards my family are over. I'd like to work for another year, go back home to my country, set up my own business, enjoy life and get married again. I don't want to go on living alone. The wages are good in Hong Kong but one has to make an unbearable number of sacrifices. I'm sure life will be better in the future."

In Hong Kong, 24 000 Filipinas do the same kind of work as Estella, and in Singapore, 7000. Eighty percent of them work for Chinese families, the others in households of a variety of nationalities. Their daily tasks include looking after children, preparing meals, doing the usual household chores, running errands, and buying the groceries.

The phenomenal industrial and commercial expansion of Hong Kong has encouraged local labour to find better paying work with local companies and has drawn married women with qualifications out of the home and into the enormous labour market. Cheap labour to fill the gap now comes from foreign countries. In 1982, 8082 Filipinas came to Hong Kong to work as housekeepers compared with 1232 in 1977. Last year the Hong Kong National Employment Office authorized 19 883 work contracts, including renewals.

Why are Filipinas more sought after than their competitors? Not only are they considered honest, gentle, maternal, responsible, and patient, but, as natives of a former U.S. colony, they speak English fluently and are well educated. About 45 percent have a diploma or university degree.

OVERQUALIFIED BUT IN NEED OF MONEY

Juliet, another Filipina working as a housekeeper in Hong Kong, has a bachelor's degree in applied sciences. "I put my pride in my pocket to take this kind of work," she says. "I wasn't trained for it and I'm over-qualified. I needed money to help my family who gave up so much so that I could study."

After Sunday mass, which they unflin-



Photo : Denis Marchand

Sisterly solidarity: Filipina housekeepers relax in a Hong Kong park on their day off.

ly attend, housekeepers on their day off meet in the public gardens around the post office. They laugh, sing, write letters, picnic, share their joys, sorrows, friendship, and solidarity. To see them one would suppose that they were all happy and most of them claim to be content and well treated. "It's quite

"The wages are good in Hong Kong but one has to make an unbearable number of sacrifices."

true—most of us seem to be happy. Our smiles, even at the most difficult moments, surprise and charm people. They look at us without even imagining that we lead painful lives full of sacrifices and that most of us are lonely," says a woman named Lorna. "Leaving one's husband, children, loved ones, leaving one's family, cultural, and social life, no matter how poor one is, is a heavy burden which all of these women bear."

And most are indebted. In desperate need of money, some paid between \$1000 and \$3000 (up to 20 000 pesos) to obtain their jobs. A number of employment agencies profit from the strong demand for overseas work by taking kickbacks. The law covering

such employment is clear—the fee is \$75 (500 pesos). It seems, though, that Philippine justice turns a blind eye to this fraudulent practice, despite condemnations by numerous organizations and unions.

The women often end up selling their livestock, mortgaging their possessions and plot of land, and borrowing the money from friends, relatives, or loan sharks who charge exorbitant interest rates of up to 60 percent.

As a result, the first six months as housekeepers are crucial and hard. The women dare not lose their jobs and are constantly in terror of being dismissed for the smallest slip. Indebted, intimidated, scared, and lacking any experience of life in a foreign country, they carry out their duties without knowing anything about their rights or how to exercise them if their employer doesn't respect them. They offer no resistance to the whims of some employers who are fully aware of the hold they have on their employees through the visa system.

"In this initial period, we all go through the same feelings of anxiety, loneliness and insecurity as are suffered by other women in similar circumstances—the wives of bankers, of Chinese, Italian, or Canadian diplomats. It is a feeling which often comes out as a depression or an exhausting hormonal and menstrual disturbance. We endure it in silence," says Lorna.

"If she doesn't satisfy you, we'll take her back and provide another one." This is the promise that some agencies make in their ads in the daily *South China Morning Post* of Hong Kong. Employees aren't offered any such guarantees. Regardless of how unhap-

py or unsatisfied they are, the law doesn't allow them to change jobs without a signed letter of termination and reference from their employer. This dependency trap breeds much discontent.

The women work under sometimes difficult conditions, go through spells when they don't get enough rest, are forced to take on extra duties not included in the contract, and have no freedom or private life because they are forbidden to have friends visit or phone them. In addition to all this they often have to defend themselves against various kinds of improper behaviour. Some are paid less than what was stipulated in the contract, forced to work illegally for another employer, or even beaten, starved, or sexually harassed. "The family even took me to their vacation home one weekend to look after the children, so I lost my only weekly day off," says Ledia, another housekeeper, with a sigh.

The long list of complaints against employers includes the illegal confiscation of passports, threats of deportation for no given reason, and the refusal to allow employees to give their version of what happened.

A PROFITABLE INDUSTRY

Among the one million Filipino contract workers in 111 countries, 50 000 work as housekeepers in Europe, America, and Asia.

The impoverishment of the Philippine rural areas—together with a 25 percent unemployment rate in the larger cities, poor prospects for job advancement, low wages, bad working conditions, permanent job insecurity, and a staggering increase in the cost of living—has forced people to turn to other horizons to earn a living. The Philippine government has greatly encouraged the export of local labour to strengthen the national economy in its struggle with an enormous foreign debt load. It has become a kind of economic bandage for all the ills plaguing the country, and a new, profitable industry which has enriched many middlemen.

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Private employment agencies each place about 30 employees a year and make a gross income of 50 000 pesos. There are about 600 such agencies in the Philippines alone. The government also benefits. Granting licenses to employment agencies, issuing passports and visas, and collecting a number of taxes and duties bring the government a small fortune.

The government has been keen to earn foreign currency and, in December 1982, it decreed that overseas contract workers must transfer 70 percent of their earnings back to the country through Philippine banks. The decree has had a drastic effect



Photo : Denis Marchand

In demand: Filipina domestic workers have a reputation for being gentle, maternal, honest, responsible and well educated.

on domestic workers. They are required to deposit 70 percent of their Hong Kong dollars in a Philippine bank branch which, in turn, buys U.S. dollars and then exchanges them for pesos before transfer to the customer's personal account. The two exchange transactions result in two charges at rates generally favorable to the banks, which are operated by the government.

The workers feel cheated and robbed. "The decree runs counter to personal rights and freedoms, because workers don't control their own money," says Cynthia Tellez, director of the Hong Kong-based Mission for Filipino Migrant Workers.

Emigrant workers in fact transfer only 50 percent of what they earn back to the Philippines through the banks. The remainder filters through the black market because of the high transaction rates charged by the banks, the slowness of transfers from one branch to another, and the less favorable rate of exchange compared with that on the black market. In a situation in which it costs a family with six children a minimum of \$190 a month to live, every dollar counts.

This massive export of labour brings immediate benefits to the country and individu-

als. It lowers unemployment and brings in foreign currency, income that is highly valued by both the workers and their families. On the other hand, the negative effects still pass almost unnoticed.

In some countries, especially Hong Kong, governments have been making efforts in recent years to clean up and regulate the working conditions of housekeepers. They have already achieved remarkable results.

In the Philippines, the increasing numbers of children and old or handicapped people who are neglected, the rising divorce rate, and the number of conjugal breakdowns resulting from long separations are all new phenomena in a country where the family is still the social mainstay. The mass migration of trained and qualified labour, this exodus of skilled, educated, hardworking and motivated people, will surely end up creating shortages that will hinder the development of the Philippines. □

Denis Marchand is a freelance Canadian photographer and journalist

SURVIVAL STRATEGIES

IN THE ANDEAN COUNTRIES

By ANDREA DOUCET

Agripina, the slight and energetic Quechua leader of the women's club in Barrio de Dios (Village of God), tells the other women at their weekly Wednesday meeting that they must devise new "survival strategies".

Barrio de Dios is one of 52 urban squatter settlements outside of Cusco, Peru's tourist capital. Since its founding 19 years ago, this village of 280 Quechua Indian families has managed with little help from the municipal authorities to install five public water taps and the beginnings of a community sewage system. The women's club has established a kindergarten, a primary school for grades one to three, and a nonprofit store which sells wood, a scarce commodity during the rainy season. They are now organizing a Comedor Popular (public kitchen) to provide collectively prepared nutritious meals to the village. Twice a year, Agripina meets with other women leaders from urban squatter settlements throughout Peru where they discuss their respective survival strategies. In Agripina's words: "This is our response to the present crisis. So few of us have jobs. We have no money. We will work together for better water, electricity, latrines."

In Bolivia's remote province of Chaparé, 320 km east of the capital city of La Paz, Rosa Mendez lives with her husband and five children in a small two-room house. She is one of roughly 400 000 Bolivians who earn a living growing coca leaves or grinding them into a paste that is processed into the pure white narcotic which is smuggled overseas.

Chaparé is the world's prime source of cocaine. Coca leaf produces five crops a year (rice produces only one), does not suffer from any known disease, and provides tremendous earnings to formerly impoverished peasants. Rosa used to live in a small mud hut. Now she can earn in a day what a Bolivian teacher earns in a month. She knows little about the illegal product made from these coca leaves. As Bolivia's economic recession deepens and as traditional industries slide into decline, Rosa has found a profitable way of coping with the crisis. She is part of a new underground economy which has taken root in the last six years and blossomed into a billion-dollar industry. "Gracias a la coca," she smiles. ("Thanks to the coca".)

These two stories represent variations on a common theme—the response of Latin Americans to the present economic crisis. It is a crisis characterized by recession, widespread unemployment, a crippling burden of debt, political upheavals, and wholesale migration of people from rural areas to urban centres. In each Andean country, there are hundreds of thousands of stories like Agripina's and Rosa's.

While the stories are easy to describe, analyzing them is not so simple. According to José Luis Reniqué, a Peruvian historian:



Photo: Andrea Doucet

In the Andean countries, many rural people move to the cities in search of work, often ending up as street vendors. The men arrive first, followed by wives and children.

"It is necessary to create in Latin America analytical concepts which are distinct from those developed for the comprehension of post-Industrial Revolution Europe. While social actors appear similar in appearance—students, teachers, urban workers, peasant farmers, women, ethnic groups—they are distinct within their own particular context, with their own struggles and contradictions."

These social actors include: Juan Carlos Perez, a school teacher who gains his main source of income from selling U.S. dollars on the black market in Bolivia; Orphie Jimenez, a 15-year-old domestic worker and prostitute in Ecuador; and Mario Vargas, of the Puno highlands in Peru, who is both a peasant farmer and a seasonal factory worker in Lima. "How do we make sense of this?" asks José Luis Reniqué.

IDRC-funded projects in Bolivia, Ecuador, and Peru try to do just that—"make sense" of Latin America's social map—while at the same time developing Latin American research capabilities, and making suggestions for new policies. Researchers such as Reniqué are looking at how different social groups respond to the changing patterns of political and economic development.

Information for the projects has been gathered through household surveys, interviews with community and government leaders, and through a search of the literature at various research institutes.

In Cusco, Peru, José Luis Reniqué spent a week visiting Barrio de Dios where he sat and tape-recorded stories on the history of the settlement and the women's communi-

ty group. Narda Enriquez, Peru's project coordinator, has spoken with and listened to workers in a beer factory, members of a rural women's jam-making cooperative, shoe-shine boys, and 13-year-old girls who sell cornmeal tamales in the street until sundown. A key question for these Latin American researchers has been: "What are the survival strategies?"

MIGRATION PATTERNS IN PERU

The concept of survival strategies emerged in the early 1970s to describe how individuals and households, in spite of their poverty and marginalization, are able to cope with the changes caused by 'development'.

Previous field studies in the coastal valley of Bajo Piura and in the highlands of Puno reveal that migration, both permanent and seasonal, is a major survival strategy for Peruvian families.

About 23 percent of the rural dwellers in both regions have migrated, mainly to the city. The basic motivation for permanent migration is economic—the search for a job or better agricultural land. In other regions of Peru, it was discovered that permanent migration is related to pull factors such as educational opportunities outside the region.

Permanent migration, as a survival strategy, has major social implications. Data from Puno show that migrants depend upon family and kin to minimize the risk and costs of economic and emotional uprooting. In the

highlands, three out of every four migrants obtain information about their destination from friends, relatives, or neighbours who have already moved there. After migrating, those who find work send money and presents home. By maintaining links with relatives 'back on the farm', a migrant has greater assurance of returning home if an urban job does not materialize.

Generally, permanent migration means the entire family moves to the city, or to marginal lands outside the city which become 'urban squatter settlements'. In Cusco, Peru, 70 percent of migrants live in two-room dwellings with earthen floors. Only 44 percent of the families in these settlements have access to potable water. The overwhelming majority (80 percent) have no sewage or sanitation facilities.

Urban industries are unable to absorb all the migrants and more than half are unemployed or underemployed. Women find work more easily than men as domestic servants, washerwomen, or small retailers.

Seasonal migration is another survival

areas. As many as 65 percent of Bolivian workers—men, women, and children—now earn a living in the informal sector. They shine shoes, sell sweet breads and mangoes, and even set up typewriters in the streets to offer typing services. Or in Chaparé and Cochabamba they find work in the "coca economy".

Cocaine accounts for as much as one third of Bolivia's GNP and two thirds of exports.

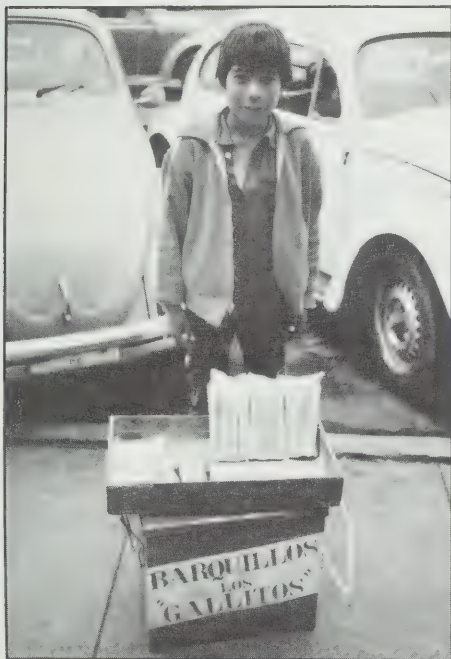
in all stages and aspects of the projects.

They have a strong commitment to sharing their findings with national, regional, and local governments as well as with grassroots community organizations. Researchers have developed methods for assessing how existing government policies respond to regional and sectoral demands and have made recommendations designed to improve national and regional development



Photo: Andrea Doucet

Moving to other lands or to the city is often the only solution.



New arrivals, such as this young seller of crepes in the streets of Lima, Peru, invariably gravitate to the informal economy.

As the illicit coca economy has grown, so have the legitimate businesses that serve its workers: grocery stores, repair shops, and dry goods outlets. Virtually all land and human resources in Chaparé are devoted to the coca leaf. Buses filled with men, women, and children run daily between the cities of Cochabamba and Chaparé. These people bring baskets of bread, burlap sacks of staple foods, as well as a wide range of services. In Cochabamba, small industries have started up, providing the intermediate goods for preparation of cocaine paste.

The underground coca economy has also given rise to another illegal activity—the importation and sale of US \$200 million worth of contraband goods each year in Cochabamba. The money earned by the nation's few narco-trafficking merchants is used to import domestic electrical appliances from Taiwan, watches from Japan, auto parts from Brazil, food and clothing from Argentina and Chile. These goods are sold in Cochabamba's bustling central market, "La Cancha".

The coca economy has many guises. In "La Cancha", the informal sector and the contraband economy exist side by side: one hears the booming voices of migrant men, women, and children bickering and bargaining to sell compact disc stereos, quartz watches, and Brazilian powdered milk products. In downtown Cochabamba, the streets are lined with Mercedes Benz automobiles and the sidewalk shoppers browse in luxury boutiques—a reminder of the wealth earned from illegal trades. And in Chaparé, a thicket of TV antennas pokes up above dusty adobe roofs—peasant farmers have learned to cope with the crisis in the most profitable of manners.

While one of the objectives of the IDRC-supported projects is to try to understand phenomena such as the "coca economy", another is to increase research capacities in Bolivia, Ecuador, and Peru. Young Latin American researchers have been involved

schemes. "This is not simply academic knowledge," explains Roberto Laserna, director of Bolivia's Cochabamba project. "We have put this information at the hands of governments and local groups—labour, small business, women—so that they may increase their own capacity for social action."

In Cusco, 70 percent of migrants live in two-room dwellings with earthen floors.

Laserna says there has been a preoccupation in Latin America to search for new forms of participation in the development process. And the projects have revealed an array of responses to national and regional development: in Cochabamba, Bolivia, teachers and students have emerged as strong social actors who have recently waged strikes and acts of civil resistance in response to government austerity measures; in the urban squatter settlements of Cusco, women's views on government services and appropriate community actions are vastly different from those of the men; in Ecuador, there is a fierce regional competition for state investment between the cities of Quito and Guayaquil; and in Barrio de Dios, Peru, Agripina is organizing a knitting collective to raise money for her community's public kitchen.

These and other survival strategies have to be taken into account when drawing and making sense of "the social map" of Bolivia, Ecuador, and Peru. □

Andrea Doucet is a Community Development Consultant for Cowater International. She was recently in Bolivia and Peru on a Canadian International Development Agency (CIDA) scholarship, conducting research on women's roles in water supply.

A BLIND MAN'S VISION

TURNING CHARITY UPSIDE DOWN IN THE CARIBBEAN

By FRANK CAMPBELL

From time immemorial, development has been the prerogative of the able-bodied. Handicapped people have been regarded as the passive recipients of charity and their involvement in productive activity has been rare and mostly peripheral. But this is changing. The Antigua-based Caribbean Council for the Blind (CCB) is playing a pioneering role in that change and is providing a lesson and a challenge to development specialists everywhere.

have the disease should seek early and regular checkups with an ophthalmologist.

The blindness-prevention segment of the Council's work is executed through the subsidiary Inter-Island Eye Service. The service brings ophthalmologists from Britain and North America for stints of 2 to 10 months, mainly in the smaller Caribbean islands. According to Webson, many of these countries would otherwise be deprived of such a service. Some of these specialists have also



Photo: Frank Campbell

The Caribbean Council for the Blind helps sighted people protect their vision by providing the services of eye specialists.

The CCB is turning the idea of charity upside down. According to executive director Aubrey Webson, helping sighted Caribbean people save their vision is a dominant part of the Council's three-point program. The other two are the traditional welfare function and a major scheme to provide employment for blind people and to pull them into the economic mainstream.

This program has earned Webson the accolade "a farsighted Antiguan" from the *Nation's Voice*, a local newspaper. The farsighted 32-year-old manager has been blind for more than 25 years. "If someone had thought of such a program much earlier, many people who are blind today would probably still have their sight," he declares. "I always say that if we help everybody in our region to keep their sight, then there would be no need for a number of extra services except, of course, for those who are already blind."

The Caribbean has a large share of the world's 42 million blind people—some 135 000 in the CCB's 22 member-countries. Cataract and glaucoma are the main causes of blindness in the region. Cataract is curable; glaucoma is controllable. The latter is also hereditary although, according to Webson, most Caribbean people are unaware that anyone whose parents or grandparents

given lectures and provided "senior support" at Barbados' Queen Elizabeth Hospital, a leading medical institution in the region.

This commitment to blindness prevention does not detract from the traditional welfare programs for the blind organized by the CCB and its affiliated national organizations. In future, however, welfare-type activities will be aimed mainly at senior citizens and at those with multiple handicaps.

JOB TRAINING AND CREATION

For most others, the emphasis will be on job training and job creation. The aim, says Webson, is not merely to get blind people onto the job market, but also to let them set their own goals and develop the confidence and the ability to achieve those goals. "That gives power and dignity and respect to the blind person."

Three types of employment can be made available to blind people according to their abilities and aspirations. There is the "sheltered workshop", the traditional workplace for many kinds of handicapped people. There are self-employment opportunities, including farming and commerce. And there is the open market. The CCB's program accommodates all three.

The program is quite young but already the results are promising. One lawyer has been learning to get to his office and to the courts on his own so that he can defend his clients just as he did before losing his sight. In one country, two previously unemployed people, both blind, have gone into farming—one cultivating crops, the other raising poultry. Several artisans are returning to the trades they practiced before becoming blind.

Inspiration, guidance, and training are provided by six specially trained rehabilitation officers. Another eight are currently in training. The 15-week course is divided into 11 weeks in a classroom setting, a three-week practicum in the trainee officer's own country, and a one-week tutorial assessment.

The officers help their blind clients decide on rehabilitation goals, including preferred employment opportunities. "They were taught," says Webson, "that even if the goal of a client was unrealistic they must not tell him it's unrealistic; they have to work with him so that he can see for himself that it is unrealistic." Having assisted the clients in

Two previously unemployed people, both blind, have gone into farming—one cultivating crops, the other raising poultry.

setting their goals, the officers then help them obtain the necessary training.

The rehabilitation officers are knowledgeable about community resources. They must help their clients deal with government welfare and other services, nongovernment funding agencies, and so on. Since each employment project is generally expected to be business-oriented, clients must know how to deal with the local bank and with any other business that might provide funds or market outlets.

Apart from working with about eight clients at a time, the new rehabilitation officer must train health and social workers, both professional and volunteer, in the community. The CCB's long-term aim is to have this employment program, as well as blindness prevention, eye care, and education for blind people, fully integrated into other community and national services.

International response to CCB's "farsighted" approach has been positive and Webson and his executive are pleased. The Council has obtained financial and other support from government and nongovernment bodies in the Caribbean, Canada, the United States, and the United Kingdom. It has also received tremendous moral support at international gatherings concerned with the rehabilitation of blind people, and of handicapped people generally, in the developing world. □

Frank Campbell, a journalist by profession and a former cabinet minister and ambassador for Guyana, is Foreign Affairs Officer with the Caribbean Community (CARICOM) Secretariat. He is based in Georgetown, Guyana.

LUCRATIVE LATRINES

By STEVEN HUNT

Pedro Pzay Tomás, a Guatemalan Indian, is eager to show visitors his property that houses his extended family of 40. He quickly points to a variety of crops growing on his small family plot, 8 km from Lake Atitlan in the small village of Chicoy.

"For household vegetables we use the fertilizer that comes from the latrine," says Pedro. "That's why we find the latrine so important."

Pedro is building his fifth 'dry compost' latrine. The fertilizer it will eventually provide him with gives this design a major advantage over the conventional pit latrine.

A few years ago it would have been an unusual sight to see someone like Pedro so enthusiastic about sanitation technology. Guatemalan Indians generally prefer to defecate in the fields in the belief that it provides their crops with important nutrients. But the population around Lake Atitlan is dense and the water runoff from the surrounding settlements has polluted the lake.

Since the early 1930s the government has attempted to encourage the Indians, through various programs, to convert to pit latrines. These, it was argued, would at least provide some protection against the spread of disease. But despite subsidized pit latrines and health programs outlining their benefits, many Indians have refused to change their habits.

Guatemala is a poor country. The majority of the population lives in tiny rural communities and only one-tenth of these people have piped water supplies or latrines.

Under a 1977 World Bank contract, CEMAT surveyed San Pedro Laguna, a Guatemalan Indian village of 5000 inhabi-



Photo: Steven Hunt

Men at work: The openings in the brickwork of Pedro Pzay's latrine—the fifth he has built—give access to the resulting fertilizer.

"We at CEMAT looked for another type of latrine," says Caceres. "We searched the literature and came up with the Vietnamese dry latrine (see box) that's been used for the past 25 years. The latrine provides villagers with the fertilizers they want for their garden."

CEMAT found the response to the dry compost latrine remarkable. Villagers who had previously refused to use pit latrines were using the dry compost model.

CEMAT has since built close to 150 of the latrines in Guatemala. Another 150 have been constructed by a private company and 300 more by CARE, a private international development agency.

A study funded by IDRC indicates that the dry compost latrine is safer to use than conventional latrines. Thirty percent of conventional latrines contained polio virus but the dry compost latrine had next to none.

The fertilizer was rich in phosphorus and organic matter but relatively low in nitrogen.

The dry compost latrine is designed for a family of six to eight people. With an extended family of about 40 people, it's obvious why Pedro Pzay is busy building another.

"The faster it's built, the sooner we'll get the fertilizer. And there is never enough fertilizer." □

Steven Hunt is an independent writer/broadcaster based in Ottawa.

WASTE NOT, WANT NOT

The dry compost latrine consists of two large chambers made of concrete or a similar material. A portable toilet seat is placed over the opening of one of the chambers.

Each chamber is designed to funnel off the urine into a separate container. The urine is allowed to stand for three days and then is used as a liquid fertilizer.

After each defecation, stove ash or a soil-lime mixture is placed in the chamber to keep it dry and inhibit odours. Once the chamber is full, it is sealed and the other chamber is used.

It takes six months for the contents of the sealed chamber to be transformed into rich, safe fertilizer for the household garden. An opening in the back wall of the chamber gives easy access to the fertilizer.

The dry compost latrine provides Guatemalan villagers with the fertilizers they want for their garden.

tants beside Lake Atitlan. It found that the conventional latrine provided Guatemalan Indians with no economic incentive to convert to its use. It conflicted with the families' management of their crops and constructing it used up scarce financial resources with no productive return. But most important, the Indians believed that to stop defecating in the fields would damage their food supply.

"Programs since the 1930s to promote the use of pit latrines have failed because there were no economic incentives for the Indians to cooperate," says CEMAT director Armando Caceres. A government program made them mandatory from 1930 to 1944 and promoted them again in 1958 and 1974—but with very little cooperation.



GRASS . . .

Photos by DENIS SING

Text by NEILL MCKEE

projects throughout Asia to help solve some of these biological mysteries; to collect, classify, and preserve different species; and to study the effects of fertilization and soil types on yield. The researchers are also learning the best methods of preserving bamboo for more efficient use in construction, handicrafts, and tools. And they are studying ways to intensify the production of edible bamboo shoots.

In Anji county of Zhejiang Province, China, bamboo forests stretch as far as the eye can

see. As the spring rain ends and warm winds blow in from the south, pickers walk in solitude through the culms gathering the young shoots.

When the air is still the pickers can hear the shoots growing, for bamboo can grow over a metre in 24 hours and reaches full maturity within a year. It seems to be in a hurry yet it is one of the most ancient plants on earth—100 to 200 million years old. Some have said that bamboo, like the horse, the cow, wheat, and cotton, has influenced

man's own evolution. Or in words spoken over 800 years ago by a Chinese philosopher, Pou-Son-Tung: "A meal should have meat, but a house must have bamboo. Without bamboo, we lose serenity and culture itself." □

Neill McKee is IDRC's film producer-director. Denis Sing is an audiovisual assistant at the Centre. They recently returned from China, Malaysia, and Thailand, where they shot a film on bamboo use and IDRC-supported research. The documentary will be released in early 1987.

PIONEERS OF THE AMAZON

By ROBERT CHARBONNEAU

Luís Vargas is not working today. There's no use going into the field when it rains because the reddish mud makes walking dangerous and any path impassable. In any case, the rice field is a long distance from the farmhouse and the highway.

This is Peru's Amazon region, that great expanse of woodland and forest covering 60 percent of the country's total area. The land that Vargas farms, called Fundo Berlin, runs along the only road connecting Lima, 1800 km to the west on the other side of the Andes, and the town of Pucallpa on the Ucayali River, a tributary of the Amazon. Here, trucks loaded with all kinds of merchandise line up to have their contents transferred onto barges that will travel down one of the most powerful rivers to Aquitos and Manaus and then on to the Atlantic.

Vargas is new to farming. Like many others, he came from the mountains to settle on what is considered a land of the future. Wasn't it here in the Amazon that oil deposits and lodes of gold were discovered? The government is giving land to anyone who wants to farm it, a 100 or so metres along the Lima-Pucallpa highway. It is up to the farmer to clear the land westward toward the mountains, sometimes over several kilometres. The only condition is that 10 percent of the land be cultivated.

With his wife and sometimes his children, who go to school in Pucallpa, Vargas has managed to clear his land of brush. He planted 2 ha of rice (which sells well), a bit of corn and cassava, even a few orange and lemon trees near his house. Much of the land is pasture where Vargas grazes his 20 odd head of oxen and cows. His other livestock includes some hogs and poultry.

LAND TURNED INTO PASTURE

Vargas practices what is called itinerant subsistence farming but his harvests are not what they used to be. The soil has grown poorer. In the beginning, rice yields were quite good—1500 to 2000 kg/ha—but after two harvests, "the soil has nothing more to give." He is letting the land turn to pasture and is clearing another section up along the hillside. Two harvests from now this plot too will become pasture for his animals.

The rice field is now far from the road. Taking the harvest to market has become an arduous chore, but this is nothing compared with the poor yields Vargas is getting. His pastureland is growing old and is becoming overgrown with weeds. With a productive life of seven to eight years, this land will eventually be abandoned and taken over by brush.

To support his small family, Vargas works a "fundo" of 50 ha; most of the neighbours have twice that amount. To maintain production and feed his livestock, Vargas finds himself moving farther and farther away from the highway.



A typical farm in the Peruvian Amazon. Here the vegetation grows on a thin covering of arable soil, only 5 to 10 cm deep.

There is only a thin, fragile layer of arable topsoil, 5 to 10 cm deep. Rain turns the clay earth into a quagmire. Erosion quickly takes its toll on the acidic soil, made poor by the aluminum and manganese it contains. Any amount of cultivation further weakens it. Soon Vargas will have to abandon another section on the hill.

If only Vargas could afford the fertilizers he sees advertised . . . As it is, he can just barely keep his family fed. He does get a good price for the little rice he grows, not to mention the one or two head of cattle he sells each year, but he can no longer sell all of his cassava. "Last season," he says, "the price for cassava was so low that nobody wanted to sell. Truckers from the city offered 150 soles/kg (one cent Canadian) for the entire harvest. It was either take it or leave it."

AN OFFER OF HELP

Vargas wanted to find ways to improve his operation at Fundo Berlin. That was why he accepted an offer of help from researchers at the Instituto Veterinario de Investigaciones Tropicales y de Altura (IVITA). The IVITA research station is nearby, only a few kilometres from the Pucallpa highway. For years, teams of researchers at the station had worked on all kinds of solutions to help improve the livelihood of farmers like Luís Vargas. Taken one by one, the solutions required little work but would greatly increase income and improve profitability. Last year the station's director, Silos Gonzales, who is from the region, invited local farmers to visit the facility. There they saw experimental pastureland containing crossed varieties of grasses and legumes, and a variety of cows different from those raised locally, each with a numbered plastic ring in its ear. They also

visited a cowshed where milk is produced.

"It was all quite nice but it just wouldn't work for me," Vargas thought initially. And he was, in a sense, right. On his land at Fundo Berlin, there was not enough help available, no cowshed, no milking cows, just the local breed that all of his neighbours raised.

A PROPOSITION

But IVITA researchers Guillermo Meini and Manuel de la Torre had devised a project to help farmers take advantage of the results of their research.

De la Torre visited each of the nearby farms or "chacras" and, in businesslike fashion, made Señor Vargas a simple, straightforward proposition. For one year, he and his research colleagues would visit Vargas to observe his farming methods, see what area was under cultivation, take a look at crop production and selling prices, and so on. All transactions, operations, and livestock sales would be studied. At the end of the year, the research team would propose ways in which Vargas could improve his production.

Vargas had little to lose. Given the serious decline in his production, it was better to try something, and right away, if he was to keep food on the table for his wife and three children.

Vargas farms only a small portion of his land. Much of it is either natural pasture or land left fallow. The fallow period is at least 10 years and as much as 20. In three years, the shrubs and thickets had already grown tall, some more than 5 m high. Normally after eight or nine years, weeds take over natural pastureland, making it virtually impossible to use.

As part of its work, the IVITA research team put together a soil redevelopment plan to increase farm production at Fundo Berlin. The first thing they did was to focus on Vargas' needs. It was not a question of having him give up farming in favour of raising livestock, or vice versa. Manuel de la Torre and his team proposed the introduction of a new and better type of pasture system developed at their research station. It makes use of grasses to reduce erosion and nitrogen-fixing legumes to help regenerate the soil.

Such a changeover will have the double advantage of improving soil fertility and providing Vargas' livestock with a diet richer in protein. With natural pasture, no more than one animal can be raised per hectare. The new pasture system, combining grasses and legumes, makes it possible to graze two or three animals per hectare.

NEW VARIETIES OF LIVESTOCK

The cattle bred locally are of the Zebu variety. Though these require little attention and care, they take on weight slowly and produce no milk. The IVITA researchers



Señor Vargas with two seasonal workers.

therefore suggested crossing some of these animals with Brown Swiss or Holsteins in order to breed milk-producing stock. They also recommended grazing livestock in pre-determined fields to ensure better control of feeding.

Vargas was advised to continue his multi-purpose use of the land. He still plants rice, cassava, corn, and beans, and has his pigs,

poultry, and 20 or so oxen and cows. Except for milk production, his farming operation for now will essentially be the same as before.

His new pastureland, however, will keep his soil fertile and help shorten production cycles. Instead of allowing trees and underbrush to occupy land for 5 to 20 years, he can now put land back into cultivation in less time.

The new pastures containing legumes (*Kudzu*, *Braquiaria*, and *Andropogon*) will help prevent weeds from taking over grazing areas and making them unproductive. As a result, Vargas may no longer have to open up new land to maintain production. He will be able to grow his rice closer to his house and the highway, thus saving himself the laborious job of moving his harvest over several kilometres of muddy wagon tracks.

The new pasture system, combining grasses and legumes, makes it possible to graze two or three animals per hectare.

Many people around the world could benefit from incorporating new techniques into their farming operations. A total of 200 million farmers worldwide farm on land cleared by burning. Four-fifths of all arable land in Peru's Amazon region lies fallow.

For IVITA researchers, this project has been a true test. For years they had worked at their station developing new methods and techniques. They wanted to see if this technology could be adapted to the special needs and conditions of local farmers. "A genuine exchange took place," says senior IVITA researcher Guillermo Meini. "We observed their system of production and they studied ours. For us, this was the only means of verifying our research; for them, perhaps the only way of getting out of their predicament. Everyone benefited."



Vargas needed to turn his "fundo" into a more viable and secure operation.

Around the world, particularly in developing countries, cage and pen culture of fish is expanding rapidly. Although cage culture began in Southeast Asia at the end of the last century, and pen culture originated in Japan's Inland Sea during the 1920s, it is only in the past 15 years that these methods of "enclosure" aquaculture have spread to over 35 countries.

Among their advantages are the low capital inputs required for building and maintaining enclosures and the potential for using free natural feed or inexpensive feedstuffs. Cage and pen culture systems can thus provide a feasible livelihood to people with limited economic resources. This aspect prompted IDRC to support research on pen and cage culture in several countries with varying economic and ecological conditions.

In September 1985, researchers from Sri Lanka, Turkey, Egypt, Niger, the Ivory Coast, and the Dominican Republic met in Cairo to exchange results from these and other projects whose common aim has been to adapt and develop efficient cage culture systems. The workshop was jointly sponsored by IDRC and the Academy of Scientific Research and Technology of Egypt. Different methods of stock breeding management and various diets were also compared and analyzed.

FLOATING CAGES ON THE NILE

Since 1978, researchers in Egypt have been investigating the use of floating cage culture in the irrigation and diversion canals of the Nile River system.

Researchers at the Barrage Station near Cairo have focused specifically on the problem of species nutrition—of producing a practical supplementary feed for cage-reared fish. They determined the lowest level of protein required to maintain good growth in caged fish under Egyptian conditions, an important step since protein is the most expensive component of fish feed.

The scientists also tested inexpensive agricultural by-products which could be used in fish feeds. Waste products such as tomato seeds and brewery wastes were

FENCING OFF FISH

By HOWARD POWLES

screened, and more traditional by-products such as rice bran and cottonseed cake were also examined. According to Egyptian researchers, even chicken manure could be a good source of protein if added sparingly to the diet of cage-reared fish.

Although vitamin/mineral supplements are considered essential for high-density culture in low-productivity waters, several participants at the Cairo workshop suggested these pre-mixes were not necessary if natural feed of good quality was available. This is good news for those fish farmers on small budgets who will no longer have to purchase costly imported nutritional supplements.

PROFITING FROM RESERVOIRS

Cage culture is an ideal way to take ad-

low for a cost-benefit comparison between cage culture and exploitation of whole lakes.

FROM THEORY TO PRACTICE

The development of a system that can be easily transferred to producers is the ultimate goal of most cage culture research. Projects in Sri Lanka, the Dominican Republic, and Togo illustrate this approach.

In Togo, researchers studied the growth and production of caged Nile tilapia in the highly productive Lomé Lagoon and in low-productivity lakes. Results from the lakes indicate that supplementary feeding would be necessary to produce fish there. However, in Lomé Lagoon, enriched by effluent from surrounding human settlements,

vantage of new bodies of water such as reservoirs created by hydroelectric dams. In theory, production of fish in cages can cost less than stocking and managing whole bodies of water with "wild" fish stock. Caged fish are less susceptible to seasonal fluctuations in water level than "wild" fish which depend on stable shorelines for feeding and spawning.

In Central Turkey, 2 out of 14 fish farming cooperatives have begun cage culture of "mirror carp" in the Keban Reservoir, which was created with the damming of the Firat (Upper Euphrates) River. This project will al-

low for a cost-benefit comparison between cage culture and exploitation of whole lakes.

growth of tilapias was good on natural feed, suggesting that extensive culture might be successfully practiced there.

As well, baby tilapias were produced from eggs spawned in "hapas" which are floating cages of small-mesh net containing mature broodfish. This is promising as aquaculture is all too frequently hampered by lack of young fish for stocking. Hapa production of young tilapias has now developed into a successful cottage industry in Lagun de Bay, Philippines, producing seed stock for pen culture and providing revenue for small-scale hatchery operators.

In the Dominican Republic, experiments with Nile tilapia and Silver carp were conducted in several reservoirs. Silver carp grew to a weight of 1 kg in six weeks without supplementary feed at low-stocking densities. Despite good technical results, this fish is not traditionally consumed in the Dominican Republic and marketing may require an effort.

In Sri Lanka, where the abundance of water storage reservoirs favours cage culture, scientists are trying to determine the optimum stock density and feed characteristics for small-scale culture. Their results in the Udawalawe Reservoir suggest the best total production of fish over a six-month growing season occurs with a density of 800 fish/m³, and a diet of 20 percent protein.

Sri Lankan researchers also shed some light on the importance of "thinning"—reducing the density of the fish in the cage—to obtain the best growth rate. Regular sorting and thinning may prove to be a valuable



Cage culture in Sri Lanka—an excellent way to take advantage of water reservoirs.

management practice in artisanal cage culture since it ensures optimum use of the cage space.

All of these projects are rapidly approaching the stage where economic analyses and "real-life" trials are needed to turn these experiments into practical techniques that can be followed by small-scale producers.

A MODEL TO FOLLOW

The Pokhara Lakes in Nepal offer a good model for the development and transfer of cage culture systems to artisanal users. Since the early 1970s, the Government of

CAGES AND PENS

In pond culture, fish are reared in a body of water managed as a whole. Enclosure culture, on the other hand, uses nets to contain reared fish in large bodies of water. There are two types of enclosures: cages, whose bottom is made of netting suspended off the bottom of lakes and rivers; and pens, whose bottom is formed by the lake or river bottom.

Cages and pens can be made from a variety of materials, depending on economic conditions and the environment (water depth, wind conditions) of the culture area. Capital-intensive systems use metal frames and floats, while bamboo can be used for both the frame and flotation when funds are scarce.

The biological and economic performance of an enclosed culture system depends on the interaction of several factors. These include the types of fish and feed (plant/animal plankton or supplementary feed). Salmon, Nile tilapia, Bighead carp, and Silver carp are proven performers in cages. However, pens, where detritus (organic particles) and bottom-living marine plants are available, can accommodate a wider range of species than cages.

Norway salmon culture and Nepal carp culture represent the two extremes of intensive and extensive culture. In Norway, cages are metal-framed structures up to 40 m in diameter, equipped with automatic feeders, often computer-programmed. This method depends heavily on the availability of large quantities of high-protein feeds.

In Nepal, by contrast, a minimal cage structure of bamboo is used to contain carp which easily find naturally occurring feed.



In the Philippines, where fish farming is highly developed, milkfish are not only raised in captivity but also bred there.

Nepal with the assistance of the UN Development Programme and the Food and Agriculture Organization, has succeeded in spreading cage culture technology to some 200 fishing families which formerly depended on the meagre returns from heavily exploited wild fish stocks.

At the Fishery Development Section's station at Pokhara, photos and models illustrate the long series of trials that resulted in the economically efficient system now being used. Cage designs evolved through at least four stages—from an early, bulky box built of bamboo slats, to the present light model of bamboo and synthetic fibre. The netting for this latest cage design is woven by the fishermen themselves and has proven to be the strongest and least expensive design. The fishermen have organized into cooperatives which determine when sales should be made, thus regulating what could otherwise be a chaotic, unprofitable market. Government aid to the fishermen has been reduced to the simple provision of young fish below cost and advice by extension workers.

ECOLOGY FIRST

If the prospects for cage culture so far look promising, the Nepal Lakes also demonstrate one of the problems of extensive cage

culture development. For cage culture to be successful, the natural capacity of a lake to support a certain number of fish has to be taken into account. Growth rates and production rates will decline each time a lake or reservoir is overloaded with too many cages or pens. In an attempt to solve this problem, the Fisheries Development Section at Lake Begnas is now controlling the total number of cages through a permit system.

Other problems of enclosure culture development include declines in water quality because of high fish density, restriction of flow in running bodies of water such as irrigation canals, and the exclusion of the traditional users from communal resources (water and fish) by those appropriating the space for culture. This is what happened in Lagun de Bay where traditional fishermen were displaced by the richer owners of large fish pens. The fishermen's individual annual income dropped from 10 000 pesos in 1977 to 4000 pesos in 1983.

Learning from the experiences of others, such as those in Nepal and in the Philippines, is essential if the full potential of cage and pen culture and their eventual spread around the world are to be realized. □

Howard Powles is an IDRC fisheries program officer based in Dakar.

THE WORM WITHIN

TOGO'S BATTLE WITH DRACUNCULOSIS

By BARRAY AMANA

For several weeks now, Kossi, a slight, unassuming man of about 35, has been lying at home in a dimly lit, sparsely furnished room. For years he was one of the more visible people in his village of Gameble, a community of 600 in the tiny West African country of Togo. Kossi used to farm his land with stamina and determination, qualities that once earned him a prize as best farmer at a national agricultural fair. For the last two years, however, he has been just another unfortunate victim of a debilitating disease.

Like his fellow villagers, Kossi firmly believes that the sickness afflicting him is the work of the gods or of some evil person's curse. This is why he has been desperately trying to find out its cause, seeking help from people who claim to know but really don't. Ironically, the answer lies only a few metres away from his dwelling in a pond which the villagers visit every day to fetch their drinking water.

Kossi and his fellow villagers are well aware of the existence of a thread-like parasite known as the guinea worm, which infects the inhabitants of Gameble every now and again, causing painful swelling of the lower limbs. But while the villagers still believe the disease to be of divine origin, scientists are

all too familiar with the organism's pathogenic cycle and the way it contaminates watering holes and streams.

Dracunculosis, the parasitic disease caused by the worm, has a high morbidity rate among villagers in several developing countries. In Togo, particularly in the districts of Yoto and Sio (the latter is where Kossi lives), more than half the population is afflicted every year. Because of the endemic nature of the disease, as well as the social and economic burden it places on families and entire communities, IDRC decided to fund an in-depth study of the problem by a research team from the University of Benin.

The team is trying to determine the extent of the problem by conducting an epidemiological survey, coupled with socioeconomic impact studies in high-risk communities. These studies, begun last year and intended to cover a three-year period, are being carried out in close cooperation with officials of a well-drilling and health education project sponsored by CUSO, a Canadian non-governmental organization, with the aid of the Canadian International Development Agency.

Because the contamination period and biological cycle of the disease often coincide with the growing season, agricultural production usually suffers.

The Togolese research team's work fits well with the aims of the International Drinking Water Supply and Sanitation Decade. In fact, the UN steering committee is using the fight against dracunculosis as a major indicator of the extent to which the "Decade" has been successful in seriously affected regions.

Providing villages with adequate water systems is a basic requirement the Togolese government must meet if it is to bring economic and social development to these areas, something that the people who live there have a right to expect. For it is those communities that lack reliable and safe sources of drinking water which have most suffered from a high incidence of dracunculosis.

Because the contamination period and biological cycle of the disease often coincide with the growing season, agricultural production usually suffers and this can adversely affect the area's economy. As is true with Kossi's family, the social routine of most families affected by the disease is also disrupted. Since Kossi became ill, his children



Photo: H. Zaiman / WHO

The guinea worm normally migrates to the victim's lower legs where it breaks through the skin creating an ulcer. The traditional — and highly effective — method of extracting the parasite is to wrap it onto a matchstick, at the rate of a few centimetres per day.

no longer attend school but instead must work in the fields. About 25 percent of the children in their school are absent as a direct or indirect result of the disease. This, of course, can adversely affect their education. Indeed, they run the risk of ending up as illiterate young adults, swelling the ranks of the rural and urban poor.

For Togolese officials, the solution involves the following measures: providing each village with a centrally located water supply point; ensuring that rural people have an adequate and nearby supply of clean water; and installing facilities that each provide a minimum of 700 litres per hour per 200 to 250 inhabitants. The University of Benin's epidemiological survey should be an important additional tool for the committee in charge of selecting villages for water system installation.

Dracunculosis is endemic in communities that must rely on local water holes for drinking water. It can and must be eradicated through a joint effort of water system construction and health education programs aimed at eliminating the carrier of the disease, namely the guinea worm. The IDRC-subsidized study, combined with the well-drilling project in Yoto and Sio, will help to achieve that goal.

For Kossi, who is preparing to go out and till his cornfield, the benefits will be most welcome. □

Barray Amana is a journalist with Togo's national daily newspaper, La Nouvelle Marche.

THE CYCLE OF INFECTION

The guinea worm is a slender, whitish parasite which grows to a length of between 55 and 120 cm. Unlike the female, the male guinea worm is harmless. In water, the female releases up to one million microscopic larvae that are consumed by small freshwater crustaceans called Cyclops.

Human beings are contaminated by drinking water containing infected Cyclops. Digested by gastric juice, the crustaceans release the guinea worm larvae which then grow into adults in 9 to 12 months. Once mature, the female will make her way down to the infected person's lower limbs near the skin surface. There she penetrates the skin creating a lesion through which the larvae are released when the skin comes into contact with water. The cycle of contamination then repeats itself.

Although not lethal, this parasitic disease known as dracunculosis can disable its victim temporarily. Active adults living in tropical and semitropical regions of Africa and Asia are its prime victims.

NO PROFIT, NO MEDICINE

PHARMACEUTICALS FOR THE THIRD WORLD

By RAYMOND LEMIEUX

From the research laboratory to the drugstore the road for new medicines developed for the Third World with public funds is a long and uncertain one. Marketing is in the hands of pharmaceutical firms which show little enthusiasm for markets in the South.

The World Health Organization (WHO), the sponsor of most such research, is in a difficult situation in dealing with the pharmaceuticals industry—it has to negotiate the marketing arrangements for the medicines it has patented. It's not easy to do because WHO and the industry do not share the same goal. On one side, the objective is health for all, on the other, profits. Are these irreconcilable? WHO tries to adapt. "If a firm which collaborated with us on the research decides to manufacture the product, we ask them to contractually agree to make no profit of any kind on marketing the product in the Third World," says Dr Pierre Boutros Mansourian, from the Consultative Committee on Medical Research at WHO. "In other words, we say to the industry people, 'You have developed a marvellous product thanks to us. By all means go ahead and earn all you can from the rich, but don't treat the poor the same way.' That is our basic principle."

It is true, however, that the pharmaceuticals industry is not a classic industry. Above all else, its primary raw material is the grey matter found in its laboratories. Neither is the Third World market an ordinary market. It offers nothing to stimulate the scientific creativity of industry to carry out research targeted specifically at it. "It has been estimated that the pharmaceuticals firms devote, on average, 2 percent of their research efforts to the fight against tropical diseases. On occasion the figure reaches 5 percent," says Pascale Brudon, a WHO pharmacist. "As far as one can see there is a general absence of research in the area. The companies would be quite willing to undertake it, but it simply doesn't pay. That's why WHO set up a program entitled Research for the Tropics which involves cooperating with both the universities and the industry."

LACKS MARKETING EXPERTISE

At New York University, a project to develop a malaria vaccine risks not succeeding because of distribution problems—even though human tests of a genetically engineered vaccine began in March and clinical trials of a synthetic vaccine will start later this year. Until just recently, WHO, which funds the research, couldn't reach an agreement with the industry for the mass production of the vaccine once it was discovered. However, there is no doubt such a medication is urgently needed—malaria affects

hundreds of millions of Third World people, mainly the poor. Morally speaking, how can firms make a profit from this situation? Even if WHO does own the copyright, it lacks the technical capability to market medical products. It has to deal with the industry and arrange to have medicines produced at the lowest possible price. In Geneva, they don't like to talk about what is going on with malaria. "A legal problem" is the comment.

It was only in 1982 that WHO was empo-



Imported health: The Third World depends on the industrialized North for medicines.

wered to protect inventions which result from its best efforts. There are two options: either researchers are authorized to take out a patent themselves, or else WHO does it. So far it is mainly work on contraceptives that is affected by this policy.

WHO has only one concern: that the products be sold for the lowest possible price. "After all, even if a vaccine developed by WHO is sold cheaply, the private firm still makes a profit," says Brudon. According to

There are few developing countries with even an embryonic pharmaceuticals industry.

Mansourian, it's a simple matter of calculation. "Like any medicine sold in the developing countries, part of the population can afford to buy it and the companies can expect to make a profit. They can also sell such products to travellers from the industrialized nations. And the scientific fallout from the research may induce a company to get interested in it, or techniques developed may lead to the discovery of other possible products," says the doctor.

LACK OF ENTHUSIASM

Ciba-Geigy, a huge Swiss-based pharmaceuticals company, admits that nothing it produces is intended specifically for the Third World. "All the same, we do have a parasitology research centre in India," says a Ciba-Geigy spokesperson proudly. "We also developed a medication against Bilharzia which is used everywhere in the Third World." Is it too expensive? "That brings up the whole basic North-South problem. In those countries they often don't want cheap products because it is automatically thought to be second rate and of poor quality."

The answer is similar at Hoffman-Laroche where some research in tropical medicine is also conducted. "The big problem is that it doesn't bring in much money," says a representative of the firm.

WHO invests close to \$50 million a year in pharmaceuticals research. "A vaccine can't be ordered up like a new Boeing," says Dr Mansourian. Most often universities and specialized institutes are the main recipients of this United Nations bounty. "Private industry profits greatly from university research which it didn't itself undertake," Brudon points out.

Research is only one of the links in the chain which keeps the Third World countries dependent on medicine from the industrialized North. There are few developing countries with even an embryonic pharmaceuticals industry. And yet the total sales of pharmaceuticals worldwide last year were close to \$100 billion. Ninety percent of the drugs were manufactured in the developed countries.

WHO's world assembly recently decided to call a meeting to study the adoption of a "code of conduct" for the international health community. The industry maintains that such a code would threaten the vitality of pharmaceuticals research in the private sector. The debate has begun. . . . □

Raymond Lemieux is a Canadian freelance journalist.

BIOTECHNOLOGY RE-ARMS AN OLD

By JEAN-MARC FLEURY

Only once has it ever been possible to wipe out one of the diseases that afflict humanity. The means of achieving that success was a vaccine.

On May 8, 1980, the World Health Organization officially declared that smallpox had been eliminated, the most spectacular success ever achieved by vaccination. Vaccines haven't always been so successful in combating other diseases such as herpes, diarrhea, leprosy, AIDS, flu, or the parasitic diseases. Still, they have enormously reduced the incidence of yellow fever, rabies, polio, measles, mumps, diphtheria, tetanus, cholera, and whooping cough.

Thanks to molecular biology and chemi-

cal synthesis a new breed of vaccines has begun to appear. A single injection may eventually afford protection against several diseases. At last, a vaccine against one of the parasitic diseases, malaria, is being tested on human beings. The spate of promising results in this area of medical research comes as the reward for years of work by researchers in both public and private organizations. These new developments demonstrate the capabilities of biotechnology, which makes it possible to control and modify the constant process of renewal that characterizes all living beings.

A new application of vaccinia—the cowpox virus upon which smallpox vaccine is

based—illustrates the possibilities that have been opened up.

As is well known, a vaccine is a harmless form of the pathogen of a viral or bacterial disease. In practice, this is likely to be the actual disease virus, but killed or attenuated and then injected into people in good health. Their immune system learns to recognize the enemy beforehand and is thus prepared to fight off a real attack. In fact, vaccination often occurs naturally when the body rejects a virus or other pathogen successfully and the action confers immunity.

Before the introduction of vaccination, healthy people were inoculated with a sample taken from a smallpox pustule. This ancient method of vaccination was extremely dangerous, but it was successful often enough that it was quite regularly used in Europe in the Middle Ages.

A British doctor, Edward Jenner, invented vaccination when he injected people with samples from the pustules of a similar disease in cows, cowpox. What he had observed was that people frequently in contact with cows often caught cowpox, but never smallpox. The symptoms of cowpox were harmless compared with those of smallpox. Thus, the principle of vaccines was discovered. In effect, Jenner had shown that people could acquire immunity to a dangerous viral disease by being exposed to a similar but harmless virus. This took place in 1798, before the discovery of viruses per se.

EXTRAORDINARY CAREER

Thus, the vaccinia virus of cowpox, the basis of the first true vaccine, went on to enjoy an extraordinary 'career'. In the early 1960s about 15 million people a year were still contracting smallpox, a terrible disease which killed half its victims and left ugly scars on those who survived. However, the last natural occurrence of the disease was identified on October 26, 1977. Since then the only person to have contracted the disease was a medical photographer who died after being infected in a laboratory at Birmingham University in England, where experiments were being done using samples of smallpox virus.

As a result of the eradication of smallpox, some countries destroyed their stocks of the virus and, even, of vaccines. One might have supposed that vaccinia had earned a well deserved rest, but, as it turned out, it was not yet time to retire the virus.

What happened was that scientists discovered a large number of 'blank pages' in vaccinia's genetic instructions. On those blank pages they have been able to insert instructions to make the cowpox virus manufacture substances normally produced by other viruses. Injections of this multipurpose virus



The sad face of smallpox: The next generation will be spared such disfigurement thanks to the massive vaccination campaigns that relegated small pox to the history books.

VACCINE

may eventually enable the immune system to recognize herpes, flu, hepatitis B, rabies, and perhaps even the AIDS virus.

At a workshop held during the annual meeting of the American Association for the Advancement of Science (AAAS) in Philadelphia last May, Enzo Paoletti of the Wadsworth Center for Laboratories and Research in Albany, U.S.A., explained that there was room for two or three dozen more genes in

A single injection may eventually afford protection against several diseases.

the DNA of vaccinia. Since each gene carries the code for the production of a specific protein, and since our immune system needs to recognize only a single protein on the outside of a virus in order to be able to 'remember' it, it's easy to understand why scientists don't want to let vaccinia pass into history. Although a number of genes have already been put into the vaccinia DNA, the ameliorated vaccine has not yet been tested on human beings.

According to Paoletti, the cowpox virus has the potential to become a true multipurpose vaccine, effective in a single injection against a whole series of viral, bacterial, and parasitic diseases. The possibility of modifying the grandfather of vaccines in this way is made even more significant by the fact that smallpox vaccine is, in some ways, the ideal vaccine. It is easy to manufacture and can be dehydrated and packaged in bags so that it lasts for more than one month without refrigeration. As it is a live vaccine, it multiplies in the body with the result that one injection confers adequate immunity for a long period. (With killed-virus vaccines, injections have to be repeated at fairly close intervals.) These characteristics make smallpox vaccine particularly well suited to tropical conditions.

Paoletti did, however, draw attention to some of the dangers of the vaccine. Vaccination against smallpox has sometimes brought on eczema and scarring around the place vaccinated, and even encephalitis. However, the incidence of such complications is very low. The other specialists present agreed that the advantages far outweigh the disadvantages.

Despite the increased potential of future vaccines, health specialists do not think that they alone can bring down the incidence of disease. Efforts must be made to mobilize

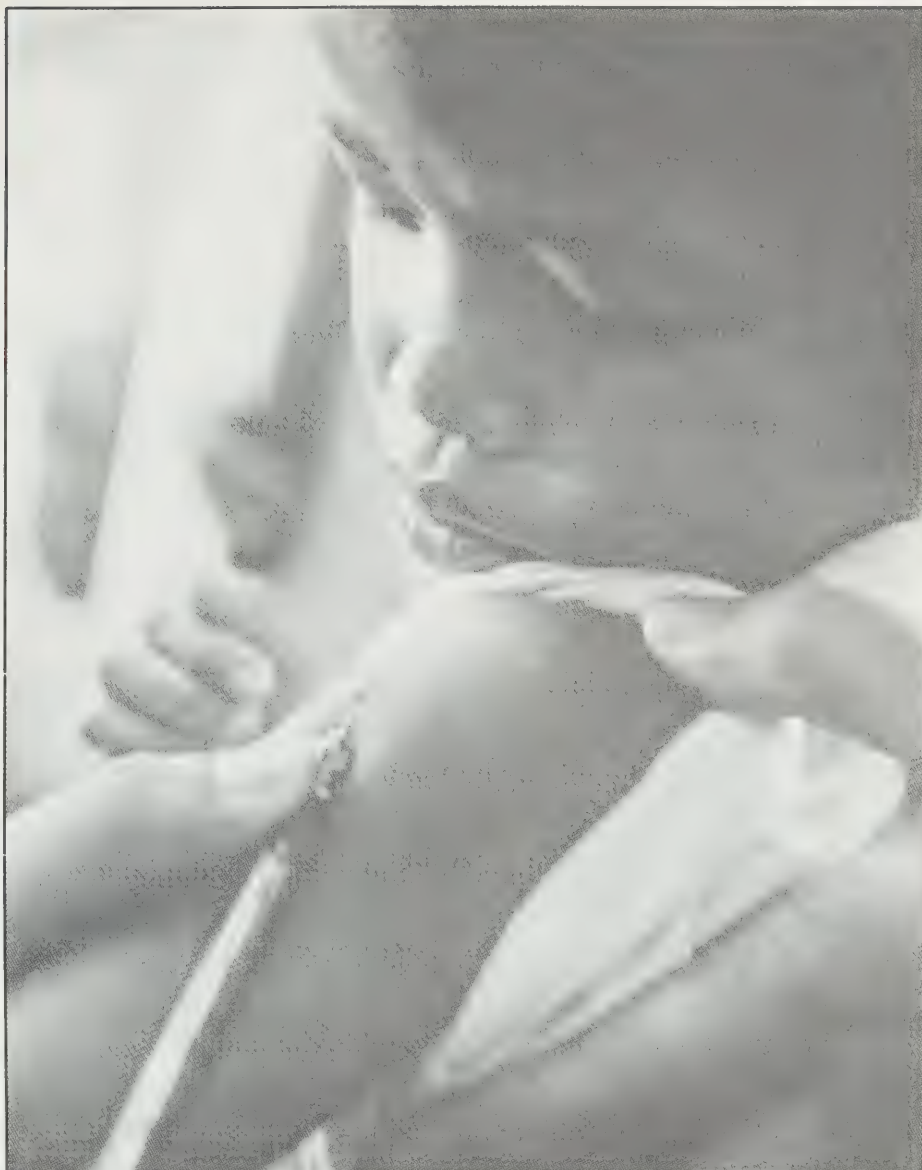


Photo: Blair Seitz / UNICEF

Biotechnology will enable scientists to develop 'omnibus' vaccines capable of providing immunity to several diseases in one injection.

the people involved. At the AAAS meeting, Felipe Cabello of the New York Medical College, Valhalla, USA, showed that although

Vaccinia is easy to manufacture and can be dehydrated and packaged in bags so that it lasts for more than one month without refrigeration.

the same antibiotics have been available in Chile and Cuba, the incidence of TB remained stable in the former country and dropped in the latter over the same period of time. In Cabello's opinion, the success recorded in Cuba resulted from greater participation by the population.

John Evan, president of the Allelix Company of Mississauga, Canada, showed how the incidence of diarrheal diseases had

decreased in a number of places, including China, the Province of Kerala in India, and the Central Province of Kenya. Health program administrators put the emphasis on maternal and child care and used a variety of marketing techniques to inform and motivate their target public.

It is most significant that a group of specialists holding a workshop on the potential of biotechnologies for health programs in developing countries should have stressed the limitations of such medical innovations. It places what was said in an altogether more realistic context. Something as limited as a single virus can be eliminated, but one cannot simply inject a community with good health. □

Further reading:

Pirates of the Cell: The Story of Viruses from Molecule to Microbe, by Andrew Scott and Basil Blackwell, Oxford (UK), 1985.

Les vaccins modernes (French), by Albert Sasson, in La Recherche, No. 177, May 1986.

A RESEARCHER'S BEST IDRC'S DEVELOPMENT DATA BASES SERVICE

Since 1980, IDRC's Development Data Bases service has helped researchers in Canada and the Third World to identify and obtain information relevant to their work. Offered by IDRC's Library, the service gives access to a pool of bibliographic and project-related information about the Third World, much of which is unavailable anywhere else in Canada.

By GERRY TOOMEY

DATA BASES AVAILABLE THROUGH IDRC

ACRONYM (IDRC): Information on English, French, and Spanish acronyms relating to international development. Approx. 4000 records.

BIBLIOL (IDRC): Bibliographic information—such as author, publisher, abstract, key words—on the IDRC Library collection which contains 59 000 books and documents, and 5000 serial titles.

IDRIS (International): The Inter-agency Development Research Information System. A cooperative data base containing information on the projects of IDRC; the Swedish Agency for Research Cooperation with Developing Countries (SAREC); the German Appropriate Technology Exchange (GATE); the International Foundation for

Science (IFS); and the U.S. Board on Science and Technology for International Development (BOSTID). Approx. 4000 records.

AID: Bibliographic information on the technical research and development materials produced by the U.S. Agency for International Development. Approx. 15 000 records.

UNITED NATIONS DATA BASES: Bibliographic information on the documents published by the Food and Agriculture Organization (FAO); the International Labour Organization (ILO); the UN Educational, Scientific and Cultural Organization (Unesco); and the UN Industrial Development Organization (UNIDO).

Information is a crucial raw material in scientific research no matter what the discipline. Academic textbooks, monographs, reference books, papers, articles, statistics, workshop reports, technical studies, conference proceedings—these and other forms of information enable researchers to keep abreast of progress in their fields, and to learn about new developments in other fields. Without state-of-the-art knowledge, scientists, whether in the social or natural sciences, whether in Canada or Colombia, risk reinventing the wheel or simply wasting valuable time and scientific resources.

Such risks are of special concern in the developing world where research funds are scarce and the conduct of scientific investigation is often under suspicion of being an unaffordable luxury. Yet it is the Third World

that is most in need of scientific efforts to solve development problems and where researchers are hungriest for information.

In many developing countries, especially in Africa, it is not easy to gain access to pertinent scientific information. Either it doesn't exist or else resources such as libraries and documentation centres are scarce and understocked.

Another hurdle is information overload. "The volume of scientific literature is so enormous that no developing country has the resources to build up an independent and comprehensive national information system," says Martha Stone, director of IDRC's Information Sciences Division. "Any attempt to address Third World information needs must be based upon resource sharing and cooperation."

The information problem is not only one

of access but of relevance. The industrialized countries, having the bulk of the world's research capacity, dominate international scientific publishing. Only about 4 percent of the international scientific literature is produced by the Third World.

Naturally the intellectual and economic interests of the industrialized countries colour their research agendas and, by extension, the mass of scientific literature they produce. Third World researchers, often involved in development-oriented appropriate technology rather than "high tech", have difficulties getting their work published. As a result, much of the scientific literature published each year in the world touches on the lives of a relatively small proportion of humanity. The concerns of the majority end up being grossly under-represented.

Furthermore, the Western bias in scientific publishing often results in Third World researchers in different countries being unaware of each other's efforts even though they are working on similar problems. This points up the need for mechanisms to enable geographically isolated scientists to disseminate their research results to each other.

Since IDRC began operations in 1970, it

has stressed the role of relevant scientific information—and ready access to it—in international development. It has done so mainly through the work of its Information Sciences Division.

Dozens of national, regional, and international scientific information centres and networks in developing countries have received IDRC support in the form of financing, technical assistance, and training. IDRC's own Library was originally set up as a project of the Information Sciences Division. In the past 15 years, it has contributed to the collection and flow of scientific information related to the Third World, has acted as a test bed for new information technologies and methodologies, and has offered advice on international information standards and training.

Since 1980, the Library has made available to clients around the world a service called Development Data Bases, which gives both Canadian and Third World researchers and other users access to bibliographic and project-related information.

The service's clients are, in order of priority: IDRC staff in Canada and its six regional offices; researchers working on IDRC-sponsored projects in developing countries; the Canadian research community which includes those in universities, non-governmental organizations, and federal and provincial government departments; and international organizations and institutions in developing countries.

For much of the scientific and socioeconomic information needed by Canadian

researchers working on Third World topics, IDRC is in fact the only Canadian source. According to a 1983 survey of IDRC's book collection, about 50 percent of the material is unique in Canada. Similarly, IDRC is the only access point in Canada to the individual data bases that list the massive literature holdings of the UN Food and Agriculture Organization (FAO); the UN Educational, Scientific and Cultural Organization (Unesco); the UN Industrial Development Organization (UNIDO); and the US Agency for International Development (USAID). In fact, no other information service in the world offers access to as many UN data bases as IDRC's Library. Furthermore, a large part of the actual IDRC collection in Ottawa and the regional offices consists of 'unconventional' literature (reports and unpublished material) received from more than 700 institutions with which IDRC has exchange agreements.

The box on the left describes the various data bases available to users of the Development Data Bases service. In the case of Canadian clients, access is available on-line, mainly through university libraries across the country.

Two of the data bases—BIBLIOL and

ACRONYM—were created by IDRC and are maintained by it. IDRIS was created in 1983 by IDRC and five other international agencies to share information about the research projects each was funding. Others, such as the UN bibliographic data bases, are of course compiled and managed by the relevant UN agency. These are continuously updated, periodically copied onto magnetic tapes, and then sent to IDRC.

The Development Data Bases service uses MINISIS, a bibliographic software package developed by IDRC in 1976. It operates on the Hewlett-Packard 3000 series of minicomputers.

In Canada, there are 85 institutional users of the service, mainly university libraries. IDRC trains their personnel in the use of MINISIS and organizes English and French users' meetings annually.

REMOTE ACCESS

Government, NGO, and university researchers in Canada wishing to search the Development Data Bases do so through their own libraries. Access is by telephone through the Datapac network and without the intervention of IDRC staff. Bibliographies and descriptions of research projects can be printed out remotely by the user. In 1983-84, about 6000 searches of the system were carried out, about half by IDRC Library staff and half by external users.

An external user wishing to obtain a copy

of an article or other publication listed in a bibliography first determines whether it is available from his or her own library. If not, but if the desired material is part of IDRC's own collection in Ottawa, there are several options. The user may request photocopies of the document from IDRC (maximum 30 pages), an interlibrary loan, or, in some cases, a microfiche copy.

If the desired document is not part of the IDRC collection, the onus is on the user to try to obtain it on his or her own. However,

and Research, which reported to the Nielsen Commission, described the IDRC Library as "efficient and effective in providing an important service to Canada's international development efforts. . . . The program is accessible to a broad clientele base."

The Act of Parliament that created IDRC empowers it to "enlist the talents of natural and social scientists and technologists of Canada". IDRC does this mainly through its Cooperative Programs which support col-

ACCESS TO COMMERCIAL DATABASES

Via the IDRC Library, on-line access to 10 commercial systems (each containing numerous data bases) is available to IDRC's staff and researchers working on IDRC-financed projects.

These systems are:

- BRS (Bibliographic Retrieval System, Latham, New York);
- CAN/OLE (Canada Institute for Scientific and Technical Information);
- DEVELOP (Control Data, Minneapolis, Minnesota);
- DIALOG (Lockheed, Palo Alto, California);

- INFOGLOBE (*Globe and Mail*, Toronto, Ontario);
- ORBIT (SDC Information Services, Santa Monica, California);
- QUESTEL (IST - Informatique Inc., Montreal, Quebec);
- MEDLARS (National Library of Medicine, Bethesda, Maryland);
- QL (QL Systems Ltd., Ottawa); and
- SPIN (Supply and Services Canada, Ottawa).

it is sometimes possible to obtain interlibrary loans of material held by the Canada Institute for Scientific and Technical Information (CISTI), the National Library of Canada, the Department of External Affairs, Agriculture Canada, and other government departments, or from depository libraries located at most Canadian universities.

The needs of IDRC staff and developing country scientists working on Centre-supported projects are given priority by the Library. IDRC hopes in future, however, to improve its service to Canadian NGOs many of whom do excellent development work but lack adequate supporting information.

Last year a task force under the direction of Canada's then Deputy Prime Minister, Erik Nielsen, conducted an investigation of the many programs funded by the Canadian Government. The Study Team on Education

laborative research projects between Canadian and developing country scientists. These programs, however, account for only a small fraction of the numerous scientific and technical links between Canadian institutions and the Third World. The services of the IDRC Library provide a complementary means of backing the efforts of the larger Canadian development community.

Making pertinent information about the Third World available to Canadians free of charge is a highly practical way of encouraging them 'to think international', to apply their skills to important issues beyond Canada's shores. □

IN BRIEF

Electronic baby scale

A new electronic scale for measuring a baby's weight is helping an IDRC-supported NGO in Sierra Leone to evaluate the nutritional status of children. Body weight is considered one of the most accurate and effective measures of health among preschoolers.

The use of six of the devices, along with other methods, will help researchers from the Community Development Council to determine the impact of hygiene and sanitation measures adopted by a local community.

The scale, with a 20 kg capacity, was designed by the Program for Appropriate Technology in Health (PATH), an American NGO based in Seattle. PATH received an IDRC grant in 1984 to complete the development of the scale which, being robust and compact, is suitable for use by health workers in developing countries.

The PATH scale has already been tested in Indonesia and Bangladesh.

Half a world in cities

By the year 2000 half the world will live in cities, says the 1986 *State of World Population* report from the UN Fund for Population Activities.

"Most of the world's largest cities are now in developing countries, and they are growing to sizes never before experienced. Mexico City is already the world's largest with 18.1 million people. By the end of the century it will have 26.3 million people."

Developing countries might seem to be following the experience of the industrialized nations whose towns and cities are now home to over 70 percent of the population. But the pattern of urbanization in the Third World is different in many respects, according to the report.

During the Industrial Revolution, factories in the cities of Europe attracted large numbers of people from the

countryside. "In the Third World today only a tiny proportion of workers can hope for an industrial job. And while the expansion of European cities was often accompanied by a fall in rural population, in the Third World both urban and rural populations are now rising simultaneously.

"Why do today's rural families pack their bags and leave? Natural and man-made disasters play their part. A prolonged drought will often force rural people to seek help in the towns—or in refugee camps which are usually sited on the edge of towns." And war in the countryside can be an even more violent impulse. Lack of land to farm, better opportunities for education, better wages, and health services, push rural people toward the cities, but not always entire families. In Africa, it is common for men to go off to work in the city leaving women and children to work alone on the farm.

The report says that as many as half of these urban dwellers will not have proper housing. "They become squatters, building shelter wherever they can find space, of whatever materials may be available—packing

crates, plastic sheeting, tin cans, leaves, bamboo or mud. Squatters usually lack water, sanitation, rubbish removal, power or paved streets... Because they have settled on land belonging to others, squatters are frequently harassed by the law, the owners or their neighbours. They do not appear on voter rolls, and their children are often not allowed in school."

For more information, contact:
UNFPA
220 East 42nd Street
New York, N.Y. 10017
U.S.A.

Rice, beans, and nuts fight malnutrition

In 1980 more than half of Thailand's preschool-age children suffered from protein-energy malnutrition (PEM). But a simple rice-beans-nuts formula developed at Bangkok's Institute of Nutrition at Mahidol University may be able to cut this number in half.

The mixture is simple and can be made by villagers at home for family use or for the whole community. Rice, Thailand's staple food, is supplemented with low-cost protein sources such as soya and mungbean, and calorie sources such as sesame or groundnut.

Roasted and ground, the mixture is packed into 100 g

or 250 g packages. The former provides about 450 kilocalories of energy. The food can be stored for six to eight weeks.

Village tests in Northeast Thailand showed the proportion of normal healthy children increased from 45 to 79 percent within eight months. The formula has since been adopted by the Thai Ministry of Health for a nation-wide campaign.

Today, over one billion children in the developing countries suffer from some form of malnutrition, of which PEM is among the most serious.

A. Indrani, *Depthnews*

Community seed banks

An information kit on collecting food-crop and other seeds is now available from the Rural Advancement Fund International (RAFI), an NGO chartered in the Netherlands.

The "Community Seed Bank Kit" is aimed mainly at agricultural extension workers. Its purpose is to help preserve the genetic diversity of the world's crops through the collection of seeds, especially by small farmers.

That diversity, important to breeding hardy, healthy new varieties, has been eroded in recent decades, primarily because of the introduction of high-yielding crop varieties on a massive scale. Fifty years ago in India, for example, farmers were growing over 30 000 varieties of rice. It is now predicted that before the turn of the century only 10 of them will account for 75 percent of the subcontinent's rice acreage.

Although the International Board for Plant Genetic Resources (IBPGR) coordinates the collection of seeds around the world for long-term storage, there have been technical and distribution problems. Canadian co-editor of the RAFI kit, Pat Roy Mooney, sees community seed banks as complementary to the existing institutional system.

The kit also recommends that wild plants used for fibre or medicine, and weeds that protect against pests, be conserved.

Among other things, the kit explains how to do surveys, organize collection expeditions, conserve seed, and identify diseased seeds.

Photo : Maggie Murray / Format



Poverty: The child of unchecked urban growth.

For information, contact:
The Rural Advancement
Fund International
P.O. Box 1029
Pittsboro
North Carolina 27312
U.S.A.

Ania Wasilewski, Ottawa

Drilling wells with bamboo

Japanese engineers are teaching Zambian villagers how to drill wells using bamboo instead of expensive machinery. The traditional method, called "kazusa-bori", makes it possible to dig wells as deep as 500 m without electricity, fuel oil, drilling rigs, or pumps.

A length of bamboo is connected to an iron head and to a large flywheel made from bamboo and timber. The bamboo drill piece is driven into the ground manually and acts as a conduit once water is struck.

The lack of foreign exchange and expertise limits rural Zambia's efforts to increase drinking water supplies, and in the capital, Lusaka, one-quarter of the 160 000 m³ of water that flows into the city each day is lost through leakage. Bamboo technology offers Africa an opportunity of "growing" its own pipes without depending on imported iron pipes and spare parts.

Mkwapatira Mhango, Lusaka
correspondent for New African magazine.

Wired tsetse fly

A Kenyan scientist has developed a method of observing the tsetse fly's response to chemicals. The tsetse, a blood-sucking insect found only in Africa, carries the trypanosome parasite which causes the often fatal "nagana" in cattle and other domestic animals, and sleeping sickness in human beings.

In the past, research on the insect's response to natural and synthetic chemicals such as pesticides was hampered by the tsetse's lethargic behaviour while under study. Dr Rajindar K. Saini, of the International Centre for Insect Physiology and Ecology (ICIPE) in Nairobi, uses a device known as an electroantennogram, with two electrodes attached to the insect's head and antenna, to monitor its reactions to

chemical odours.

Scientists are now trying to identify a chemical that will attract the tsetse so that it can be trapped and destroyed.

David Ang'ang'o, Depthnews

Technology and tools for women

"If it's not appropriate for women, it's not appropriate."

That's the logo on *The Tech and Tools Book: A Guide to Technologies Women are Using World-Wide*, recently published by the International Women's Tribune Centre and Intermediate Technology Publications.

Based on the Tech & Tools workshop held at Forum 85 in Nairobi, the book is easy to read and packed full of information about the strengths and weaknesses of various agricultural, communications, energy, food-processing, health and sanitation, and income-generating technologies being used by women around the world. These range from green charcoal made in the Philippines to cassava graters from Belize, to community cookers in Kenya, and the PVC hand-pumps developed in Malaysia and Sri Lanka with IDRC help.

With large drawings and a technology grid listing costs, training required, maintenance and construction details, *The Tech and Tools Book* is an invaluable guide for anyone interested in low-cost and easily disseminated technologies.

For more information:
Intermediate Technology
Publications
9 King Street
London WC2E 8HW U.K.

Coffee break for cattle

A processing plant near Costa Rica's capital of San José last year produced over 36 000 tonnes of an animal feed component refined from something the country has in abundance—coffee wastes.

The new feed component is 40 percent cheaper than imported corn which it partially replaces. Future plans call for extracting other valuable products from the coffee bean's sweet outer covering, including pectin, tannin, caffeine, and ethanol.

From Inter-American Development Bank News, June 1986.

NEW RELEASES

Community Participation in Delivering Urban Services in Asia



Community Participation in Delivering Urban Services in Asia.

Editors: Y.M. Yeung and
T.G. McGee. IDRC-238e,
279 pp.

Since 1945, the pursuit of accelerated economic growth by the market economies of Asia has led to rapid urban growth, a pattern that seems likely to continue. This rapid urban growth has made it difficult for city governments to deliver adequate physical and social urban services such as water supply, garbage collection, health care, education, and recreation. The problem is particularly acute in low-income communities. Given that government efforts to meet the need for increased urban services have not been totally effective, many urban communities in Asia have experimented with self-help and participatory mechanisms designed to improve the quality of urban life. This volume presents the highlights of a five-country study—involving Hong Kong, Indonesia, Korea, Malaysia, and the Philippines—that attempted to provide information on the development and operation of a range of self-help urban services.

Evaluating the Health Impact of Water Supply, Sanitation, and Hygiene Education Programs.

John Briscoe, Richard G. Feachem, and M. Mujibur Rahaman. IDRC-248e, 80 pp.

It is generally agreed that improvements in water supply and sanitation have direct beneficial effects on community health. This is especially relevant in developing countries where infant mortality and morbidity rates due to waterborne and water-related diseases are extremely high. However, for a number of reasons, the connection between clean water and adequate sanitation facilities, and improvements in health status has been difficult to establish. Today, water supply, sanitation, and related hygiene education programs must compete with other public health programs for limited resources. It is therefore important that relevant information be made available on the impact that water supply and sanitation programs have on health so that priorities can be assigned and appropriate decisions made. This monograph, sponsored jointly by IDRC and the United Nations Children's Fund (UNICEF), summarizes the results of a workshop hosted by the International Centre for Diarrhoeal Disease Research, in Bangladesh in November 1983. The workshop addressed the conditions under which health impact evaluations should be undertaken; indicators for measuring health impact; study designs which can be used; and how results can be interpreted.

In addition to IDRC *Reports*, the Centre publishes a wide range of material on development issues. These include scientific monographs, reports, and bibliographies on specific IDRC research areas, as well as general interest literature. These publications represent research interests and activities supported by IDRC in agriculture, food and nutrition, population, health, education, information, and social sciences. Films describing the Centre and some of the areas of development research are also available. A catalogue of current material, publications or films, is available from the nearest IDRC regional office or from IDRC in Ottawa (see page 3 for complete addresses.)

Publications may be ordered from the IDRC sales agents listed here.

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VOLUME 16, NUMBER 1—JANUARY 1987

Reports

THE
IDRC



Hillside agriculture



LETTERS

Beliefs about water

I have been reading *Reports* with ever-increasing interest, first as a journalist and, during the past few years, because of my work with NGOs in water and sanitation. I have read a number of references in *Reports* to the Sri Lankan program to train women to repair and maintain water pumps.

I myself have done a study called *Women and Water* which looks at another side of women's concerns with water, namely their beliefs and superstitions. The study, sponsored by the UN Development Program, was done on behalf of the NGO Water Supply and Sanitation Decade Service, an umbrella organization of 30 NGOs concerned with water and sanitation. The study took place in the village of Kitulawa, Sri Lanka, which had been supplied with 100 new latrines and six deep wells.

The study shed light on women's ideas about water and good health, the time spent in fetching and using water, and what the new wells meant to them in terms of better health and convenience. Beliefs rooted in their culture and superstitions were prevalent among all age groups. Some of these contain hard practical truths and sound common sense; others are foolish and can be harmful.

A few examples of beliefs... Some women thought diarrhea, indeed all children's illnesses, to be the work of the gods and best left alone. Some ascribed the same cause to seasonal flooding in the village. The action of some trees in purifying water is a widely held view. Some varieties of fish also are thought to make the water pure and safe to drink. It was believed that wells must always be kept open so that the sunlight acts as a filter. "Boiled water is dead

water; unboiled water from a well into which the sun shines is best for drinking," the women told me. Running water is thought to be safe water, sacred to most because it is used in folk ceremonies.

Women's generally low level of education helps perpetuate these beliefs, especially among the young. It is important to identify and modify these beliefs and attitudes—something that can best be done through the women themselves. Planners should keep in mind that traditional beliefs and practices about water are ingrained in the rural mind in Sri Lanka.

The Kitulawa village experience showed that attitudes and beliefs, however simple they sound to the sophisticated mind, have to be considered in educating women about hygienic practices. A happy outcome of the study was the realization that education, however basic, about water is an entry point to other education programs: family health and planning, nutrition, child health, and even preschool education.

Mrs Vijita Fernando
Rajagiriya
Sri Lanka

Fighting bilharzia with damsissa

I once read an article in *Reports* about IDRC-supported research on the elimination of the bilharzia-carrying snails in canals. As far as I remember, it concerned an Egyptian doctor who started the research on his own after finding out that if a certain kind of bush grows along the edges of a canal, the bilharzia-carrying snail is not present.

If you know anything about this subject, could you please send me the available information? I would be grateful, and so would the people of the Yemen Arab Republic, who, in certain areas, are suffering from the mansoni type of bilharzia.

Dan Bekker
Sanitary Engineer
Rada Integrated Rural
Development Project
Sana'a
Yemen Arab Republic

IDRC continues to support the research work of Dr Mohamed El-Sawy, of the High Institute of Public Health, Alexandria, Egypt. He has been investigating the molluscicidal properties of a wild herb called *damsissa* (*Ambrosia maritima*) which is found in Egypt, Sudan, and the Mediterranean countries. (See *Reports*, Vol. 7, No. 2, June 1978, p. 22, and Vol. 9, No. 1, April 1980, p. 22.) Dr El-Sawy and his colleagues are currently testing the feasibility of Egyptian farmers growing their own *damsissa* and applying it to their irrigation canals in the spring, just before the bilharzia "transmission season". At the same time, toxicological research has been started in order to ensure that *damsissa* has no unwanted side effects on either human beings or the environment. The process is a slow one, and it will probably be some time before *damsissa* can be definitely recommended as an alternative molluscicide. Results to date, however, have been encouraging.

Damsissa is just one of dozens of wild plants that appear to have molluscicidal properties. Another of the better known ones is *endod* (*Phytolacca dodecandra*), found in Ethiopia and other countries. Canadian and Ethiopian researchers have recently been experimenting with *endod* at Carleton University in Ottawa to learn more about its chemistry and potential as a weapon against bilharzia-carrying snails. (See *Reports*, Vol. 15, No. 3, July 1986, p. 9.)

The Editors

Corrections

On pp. 14 and 15 of the July 1986 edition, the photos of the Himalayan glaciers and research expedition were incorrectly credited. Our apologies to Kenneth Hewitt and Gordon Young, the researchers who in fact took the photos. Also, the farmers depicted in the p. 16 photo accompanying the article on legume research were Sudanese, not Syrian as indicated in the caption.

Agroforestry and computers

The Swedish International Development Agency (SIDA) is considering promoting agroforestry options for small and marginal farmers through the Social Forestry Programs it supports in India. The experience referred to in Jean-Marc Fleury's article, "Macro-solutions on Microcomputers" (April 1986) is most relevant. I would appreciate receiving any information regarding the project and its experience. I would also like some idea of the hardware on which the MULBUD computer program runs and would like to be put in touch with the people who developed the program.

R.N. Roy
Consultant
SIDA Forestry
Coordination Programme

The MULBUD software package is a microcomputer-based planning tool developed with IDRC financial support by the International Council for Research in Agroforestry (ICRAF). It can be used to help farmers to analyze the various cropping options available in agroforestry systems and to choose the most profitable ones. Information, including a leaflet outlining the uses of MULBUD and the computer equipment required, is available from ICRAF, P.O. Box 30677, Nairobi, Kenya.

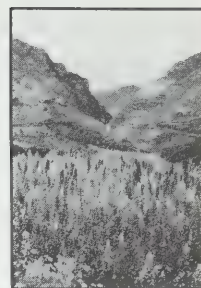
The Editors

Reports

THE IDRC

Front cover: Quinoa, a traditional crop of the Andean people. Farming on slopes poses special challenges for farmers. See articles on pp. 4-9.

Photo: Neill McKee / IDRC



CONTENTS

Letters		2
Farming on high	In fragile mountain eco-systems, making a decent living poses special problems for farmers. Geoffrey Hawtin and Nicolas Mateo explain.	4
New roots for a parched land	Kenya's semi-arid slopes are over-populated. Trees are helping farmers combat the ill effects. By Gerry Toomey.	6
The poverty of slash and burn	The Philippine highlands are burdened by the ecological strain of too many migrant farmers cutting too many trees. By Denis Marchand.	7
Ipil-ipil: mountain marvel	Father Watson mixes ancient terrace farming with modern agroforestry. Denis Marchand reports from the Philippines.	8
Cooking the Chulha way	In India, a family cookstove called the Damru Chulha and its big brother, the Community Chulha, save precious fuel. By Pravin Kumar.	10
The housing crunch	This is the Year of Shelter for the Homeless. Deogratias Byabafumu reports on East Africa's efforts to resolve its chronic housing problems.	11
Servicing Africa's cities	Like many African cities, Abidjan is attempting to deal with rapid urbanization. By Lyse Doucet.	12
Moulding the urban landscape	A photo feature on the burgeoning cities of the developing world. Text by François Bélisle.	14

A deadly shadow	AIDS is spreading through a belt of African countries at an alarming rate, killing almost as many women as men. Amy Chouinard reports.	16
The quiet epidemic	Thousands of farm workers suffer from pesticide poisoning each year. Poor equipment and ignorance of hazards are the culprits, reports Ania Wasilewski.	18
The child's ally	Vitamin A deficiency has been linked to a number of sometimes fatal children's diseases. Francis Harawa reports on a major Indonesian study.	20
From Arabic to Chinese	The MINISIS computer software system serves library users in their own language, even complex Chinese. Input from Robert Charbonneau.	21
Where have all the children gone?	A study about Colombians who skip school to work could help tune education policies to rural realities. By Elsa Ramirez de Alvarez.	22
Commentary	Thoughts from Singapore on Third World publishing. An interview with Dr S. Gopinathan.	24
Briefs	News and trends in international development.	26
New releases	Publications from IDRC.	27

IDRC

The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in five sectors: agriculture, food, and nutrition sciences; health sciences; information sciences; social sciences; and communications. IDRC is financed solely by the Parliament of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are located at 250 Albert Street, Ottawa, Canada (P.O. Box 8500, Ottawa, Canada K1G 3H9). Regional offices are located in East Africa (P.O. Box 62084, Nairobi, Kenya); West Africa (B.P. 11007, C.D. Annexe, Dakar, Sénégal); Asia (Tanglin P.O. Box 101, Singapore 9124, Republic of Singapore); South Asia (11 Jorbagh, New Delhi 110003, India); Latin America (Apartado Aéreo 53016, Bogotá D.E., Colombia); and the Middle East (P.O. Box 14, Orman, Giza, Cairo, Egypt).

The IDRC Reports

The IDRC Reports and its companion editions in French and Spanish — *Le CRDI Explore* and *El CIID Informa* — are published quarterly by the International Development Research Centre. Their aim is to keep readers informed of the activities of IDRC and to present articles on subjects related to the Centre's fields of interest. An Arabic version *بحوث للتنمية* is published annually. Copies are available on request from the Communications Division, IDRC. *Editor-in-Chief:* Jean-Marc Fleury. *Associate Editors:* Gerry Toomey (English edition), Robert Charbonneau (French edition). *Spanish edition:* Stella de Feferbaum.

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Unsolicited manuscripts and other editorial materials are welcomed and will be considered for publication.

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Legacy of the Incas: Near Cuzco, Peru, farmers continue to terrace fields.

FARMING ON HIGH

By GEOFFREY HAWTIN and NICOLAS MATEO

As much as 10 percent of the world's population—and a much larger percentage of the world's poor—live in mountainous regions. In Central America, the Andean region, and the Caribbean, mountainous areas are home to between 30 million and 50 million people and provide almost half of the staple foods. In the Andean countries, mountain farming accounts for about 35 percent of the land area. In Peru alone, 1.6 million hectares are under cultivation at altitudes exceeding 2000 m.

Besides those living in the mountains, a further 30 percent of the world's population is affected by, or dependent on, mountain resources. Rivers such as the Indus, Ganges, Brahmaputra, Mekong, and Yangtze, which flow from the Himalaya-Karakoram-Tibet mountain complex, provide irrigation and drinking water for a large

proportion of the vast population of South and Southeast Asia.

POOREST, LEAST DEVELOPED AREAS

In most countries, the mountainous areas are the poorest and least developed. In Peru, for example, 40 percent of the population lives in the mountains but accounts for only about 16 percent of the GNP. In the High Atlas Mountains of Morocco, infant mortality is about 50 percent greater than the national average. Mountain people in developing countries are predominantly rural and depend on agriculture, although in some areas forestry, mining, and tourism are important.

Historically, mountain communities have been comparatively isolated but self-reliant. Some do, however, have trade links either with other mountain communities or with

lowland communities, and may even have access to land in non-mountainous areas. Strong social cohesion and organization have been prerequisites for successful farming. In recent years, however, improved communications, migration to the cities, increasing social mobility have weakened and disrupted traditional social structures. In many parts of the world, for example, mountain terraces and irrigation systems that had been maintained for thousands of years are falling into disrepair. At the same time, expanding mountain populations in many countries are putting increasing pressure on the fragile ecosystems.

For a variety of reasons, mountain agriculture has remained a subsistence activity for the most part. Opportunities for increasing cash income are usually limited to commodities that keep well, have high value, or are easily transported. Farm holdings tend to be small and fragmented. Fields, normally small and often terraced, are expensive to maintain and offer only limited possibilities for the use of animal power or machinery.

Individual farmers often have widely dispersed fields at different altitudes, enabling them to produce a wide range of crops and animals and to spread the workload over time. In addition to their own holdings, mountain farmers generally have access to communal pastures and sometimes to communal crop lands. In Afghanistan, farmers may work the lower hills in winter, but move to temporary dwellings at higher altitudes in summer to raise crops and graze their animals.

EFFECTS OF TEMPERATURE

Mean temperature drops with increasing altitude and poses special problems for mountain agriculture. It has been estimated that in Nepal the maturity of wheat and barley is delayed by about five days for each 100 m rise in elevation. In addition, the occurrence of regular frosts at certain altitudes limits crop production. Land above this frost line is normally used only for grazing although seasonal crop production is possible in some areas. The problems of cold are often exacerbated by strong winds.

Of almost equal significance to low minimum temperatures are the large swings in temperature between day and night (diurnal variations). In parts of the Andes, for example, diurnal variation in air temperature is regularly as much as 30°C.

The extent of seasonal temperature variation depends greatly on latitude and distance from the oceans. Near the equator seasonal changes are minimal compared with latitudes farther north or south. For instance, in parts of northern Mongolia, which is on the same latitude as central Europe, monthly mean temperatures can exceed 30°C in summer and they can plummet to a chilling –50°C in winter.

The transfer of agricultural technologies

from low-elevation temperate regions to high-altitude tropical ones with the same mean temperatures is often not possible because of the extreme diurnal changes. In addition, daylength requirements of temperate plant species are often not met in the tropics, even if temperature regimes are acceptable.

Other factors affecting mountain agriculture include higher levels of solar radiation and lower atmospheric pressures. The consequences of these are not well understood.

INADEQUATE SOIL MAPS

Mountain soils are highly variable, and frequently stony and thin. Soil maps are usually inadequate; indeed, more attention could be paid to producing maps to assist in land use planning. Furthermore, many of the international soil classification systems currently in use are of limited value. It might be useful for agriculturalists to pay more attention to the often highly developed classification systems of indigenous peoples.

Dr Mario Tapia, general coordinator of the Andean Farming Systems Project in Peru, supported by IDRC and the Canadian International Development Agency, points out that farmers in mountainous areas have had to develop soil management systems adapted to highly variable weather and topography. Their livelihood depended on it.

Soil erosion is possibly the single most important hurdle to future exploitation of many mountainous regions.

Terracing has made it possible to cultivate steep slopes, and the development of ingenious irrigation and drainage systems, such as the "cochas" of the Andes, has enabled farmers to grow crops in otherwise impossible locations.

Population pressures have led to a widespread clearing of forests for fuel and for agriculture, and increasing numbers of animals have overgrazed many areas. Both deforestation and overgrazing have increased soil erosion, possibly the single most important hurdle to future exploitation of many mountainous regions.

Actual measurements of erosion losses are scarce. The direct effects of different factors (such as soil type, agricultural practices, animal species, and crop cover) on erosion in the world's mountain areas are still only poorly understood. What is known is that the downstream effects of erosion—namely, silt deposition, severe flooding in the wet seasons, and lower-than-normal water levels in

the dry seasons—are sometimes more serious than the effects of erosion on agriculture in the mountains themselves. Clearly, a great deal of research in this area is still needed.

One promising avenue is agroforestry. Greater attention to the beneficial role and potential of trees in mountain environments could have important and far-reaching consequences. (See pages 6-9.)

Typical of mountain agricultural systems is the diversity of crops grown. In one village in Nepal, for example, more than 150 distinct crop species and varieties were being raised. In small potato plots in the high Andes of Peru, as many as 12 different species and varieties of potatoes can be found.

DIVERSITY REDUCES RISK

This diversity of crops, both within and between species, is partly explained by the multitude of elevation-related ecological niches in and around mountain villages. (In Nepal and Peru it is not uncommon for villagers to have fields spanning an altitudinal range of more than 1000 m.) Crop diversity is also one of the farmer's strategies for reducing risk in the face of a harsh and highly variable climate.

Many unique crops and animals have been selected in, and for, mountain conditions. Dr Tapia points out that in areas where meat and milk were historically scarce, the domestication of grains with a superior protein content made for a well nourished population. Crops such as quinoa, kaniwa, tarwi, oca, ullucu, and mashua improved the daily diet of the Andean people. In Nepal, wheat, naked barley, buckwheat, amaranthus, lathyrus, peas, and lentils are widespread.

Certain livestock species and breeds are also well adapted to mountain conditions. The llama and alpaca are camelids that graze in the Andes at altitudes of up to 5000 m. The hardy yak is widely distributed in mountain areas of Tibet and surrounding countries.

Unfortunately, much of this diversity is rapidly being lost. The reasons are growing population pressures, an increasing demand for crops for the urban market, and competition from high-yielding modern cultivars. Indeed, the situation in many areas is considered grave. Urgent measures are being taken by various organizations to ensure these irreplaceable genetic resources are collected and maintained.

TRADITIONAL TECHNOLOGIES ENDANGERED

Over thousands of years, mountain farmers have developed technologies uniquely suited to their environment. The farming systems of the Andes, for example, are among the world's most complex. But many traditional technologies are now in danger of being lost because of social change. They were originally efficient and able to support the ex-

isting population densities, but today, unfortunately, they cannot sustain the larger populations.

However, the possibility of using fertilizers and other inputs, as well as the introduction of new crop and livestock species and breeds, are creating new agricultural opportunities in mountain regions.

LITTLE RESEARCH AND TRAINING

The agricultural research community has generally neglected mountain areas in favour of the plains which have greater food-production potential and are often more densely populated, richer, and politically more influential. Training has followed a similar pattern, emphasizing intensive flatlands production strategies, including the use of machinery and high-input technologies. The result has been more steady economic progress in the plains than in the mountains.

In recent years IDRC has provided increasing support to research and training in mountain areas—the Andes, Ethiopia, the Nepalese mountains, and the highlands of northwestern Thailand. In the Andes, the work of an informal network of projects has helped to improve the lot of farmers in several areas by making available higher-yielding varieties of crops such as quinoa and faba beans. Although the work is still at an early stage, it has shown national governments that their research and development strategies in mountain regions need to be re-examined.

On the international level, there is an increasing recognition of the need for more research. The International Centre for Integrated Mountain Development (ICIMOD), for example, has been established to address the complex development needs of the vast Himalayan region.

Although scattered around the globe, mountain ecosystems have many features in common. The sharing of scientific information and the exchange of genetic materials could contribute substantially to their advancement. With this in mind, ICIMOD will host a workshop on mountain agriculture in early 1987, with IDRC support. Appropriately, it will be held in Kathmandu, Nepal, a lofty perch where, it is expected, the scientific panorama will be as expansive and inspiring as the visual one.

Such scientific exchanges, as well as continued government and donor support for research, should lead to more productive and stable environments for the millions of people who live in the mountainous regions of the world. □

Geoffrey Hawtin is Associate Director, Crops and Animal Production Systems, in IDRC's Agriculture, Food and Nutrition Sciences Division. He is based in Vancouver, Canada. Nicolas Mateo, based in Bogota, Colombia, is a senior program officer in the same division.



Kenyan women near Machakos prepare to plant a 3-tiered hedge.

AGROFORESTRY IN KENYA

NEW ROOTS FOR A PARCHED LAND

By GERRY TOOMEY

“Look, over there in the brush. There are two of them.” Agroforester Richard Mwendandu was pointing to dik-diks, tiny antelopes that were foraging for green leaves among the sparse vegetation on a hillside in semi-arid southern Kenya. Not far away, pairs and trios of less-shy domesticated goats were also browsing for a meagre meal.

Mr Mwendandu and Dr Francis Arap Sang, both members of the IDRC-supported Dryland Agroforestry Research Project team, were showing two visitors around the Kakuyuni catchment area in the eastern part of Machakos District. This is the site of a novel experiment in agroforestry (the growing of trees and crops together). Its aim is to help farmers make a better living and to help reverse an increasingly serious trend of deforestation and erosion. Underlying that trend is an intricate chain of human and natural causes, of which the dik-diks and goats are only two small links.

In Kenya, rural population growth rate is an alarming four percent a year. This, combined with competition for dwindling arable land, has put immense ecological pressure on semi-arid areas. With people come farm animals, mainly cattle, goats, and sheep. In the Kakuyuni catchment area, the number of animals is now more than twice the recommended maximum for such grazing lands.

SOIL CONSERVATION, FARM TECHNOLOGY

A study conducted jointly in 1977-78 by several Kenyan Government ministries and development groups concluded that large

investments in soil conservation and farm technology are a must if the creeping dangers of deforestation are to be countered. In 1982 and 1983, the Nairobi-based International Council for Research in Agroforestry (ICRAF) consulted with the Kenya Agricultural Research Institute, the National Dryland Farming Research Station, and the Machakos Integrated Development Project. With funding and advice from IDRC, they formulated and launched an agroforestry research project whose final product will be a package of innovations to help farmers in the Machakos District protect their livelihood.

The number of animals is now more than twice the recommended maximum for such grazing lands.

The Kakuyuni area, at an altitude of 1500 m, covers one million hectares and supports 465 000 people, mostly Akamba. Rainfall is low, rarely exceeding 800 mm per year. The land produces little; farmers are usually unable to provide sufficient food for their families.

One area of research on which Dr Sang and his team are concentrating is the growing of rows of trees, or hedgerows, among crops to increase farm productivity and to improve and protect the soil. Called alley cropping, this technique has been adopted by farmers in many countries.

Once a hedgerow is established, the foliage can be lopped off at 15 to 30 cm above the ground. The branches are then spread out along the alleys between the hedges and the woody components removed just before ploughing and used as fuelwood. The remaining leaves and twigs are ploughed under to enrich the soil.

Initial results from the hedgerow experiments were enlightening but not very promising. Leaf matter from three hedgerow varieties (*Leucaena*, *Terminalia*, and *Cassia*) was added to test plots to determine the effect of each variety on beans and maize. Major yield increases were noted for maize. Two kg/m² of undried *Leucaena* leaves, for example, improved the yield by 22 percent. The increases, however, were offset by the fact that the required hedgerows take up 33 percent of the cropland.

For semi-arid conditions, the long-term beneficial effects of alley cropping on soil fertility and the extent of biomass potential from hedgerows are still largely unknown. The scientists therefore concluded that more research was justified.

Among other things, the researchers are investigating techniques to protect valuable trees in the grazing lands. The results of on-farm trials have been highly promising.

A survey of local vegetation revealed a wealth of naturally regenerated saplings. These are unable to mature, in part because they are constantly browsed by animals. The low water content of the surrounding soil also impedes the growth of these trees.

One species, *Balanites aegyptiaca*, also called Desert Date, produces valuable timber and fodder, as well as edible fruit if allowed to grow to maturity. “In my home area,” explains Dr Sang to underline its importance, “you cannot cut that tree without permission of the elders.”

A rehabilitation technique intended to protect *Balanites* and other species is simple and has proved highly effective. It consists of three treatments: digging a 2-metre-long “microcatchment”, a V-shaped trench upslope of the tree to improve water retention; pruning the tree to one main branch to promote upward growth; and surrounding the tree with thorny brush to protect it against animals while the main branch is growing.

“Farmers were initially sceptical about doing ‘something’ with the existing vegetation,” says Dr Sang. “They like to think of projects as bringing new trees.” Later, however, more farmers asked to participate in the scheme. The researchers are now planning to publish a tree rehabilitation pamphlet for them in Akamba and Kiswahili.

These and other technologies, says Dr Sang, “have to reach the people if they are to be of any use. At first the farmers thought we were going to rob them of their land. But eventually, they came to realize that we were there to help them improve their land. You know, I think we have won their hearts.” □



Hit-and-run agriculture: A farm in the Philippine highlands.

THE POVERTY OF SLASH & BURN

A study conducted by Silliman University reveals a vicious circle of poverty among upland Filipino farmers. Their slash-and-burn techniques produce barely enough food for them to live on and are leading to an environmental catastrophe.

By DENIS MARCHAND

For the past 20 years the forested slopes that make up 60 percent of the Philippine archipelago have been savagely denuded. Need, even survival, has been the spur. The agricultural lands on the plains have become impoverished and hunger is driving thousands of migrant farmers to virgin land on the mountainside.

As Rowe Cadelina, the Director of the Research Centre at Silliman University, admits, there has been a sizeable increase in migration to the mountain regions from the lowlands in recent years. There are many reasons, but they all originate in the poverty of small farmers. They include such things as desperate overpopulation, an unfair land-holding system, and the difficulty of finding either a job, a piece of land to farm, food, or lodging. These "kaingineros" or "upland swiddeners", as they are called in the Philippines, have been pushed out into marginal mountain land. They go further and further up the mountainside to clear tiny plots for farming.

Equipped with rudimentary implements, these settlers cut down the trees and burn the branches, roots, and surrounding vegetation. Some of the peasants, lacking suitable tools, simply set fire to live trees. As soon as they have eliminated all unwanted vegetation, they plough the land and grow crops for domestic consumption, usually corn, squash, sweet potatoes, bananas, papaya, and Manila hemp.

ABANDONED PLOTS

After a few years, their patch of land becomes less productive because of over-intensive monoculture, the lack of organic fertilizers, and the uncontrollable growth of cogon, a tropical weed. So the peasants move on to another location. The mountain slopes are dotted with abandoned clearings.

Agricultural practices of this kind lead to ecological catastrophe. Mountain soil is washed away by torrential rains. The resulting floods deposit silt over the fertile plains, ruin crops, and destroy homes, often killing people. Fishing communities are also affected since huge quantities of mud and garbage spill into the sea, driving the fish farther out.

The peasants themselves blame these disasters on the big logging companies, pointing to the practice of clear-cutting the slopes. Mr Cadelina blames farmers for a good part of the deforestation. His view is supported by the results of a Silliman University study on the behaviour and impoverishment of slash-and-burn farmers in the highlands. The research project was financed by IDRC.

If the peasants hope to survive, they have no choice but to clear new plots constantly, which perpetuates the cycle of poverty.

According to Mr Cadelina, the inefficient agricultural practices of the migrants and the ecological disturbances they create are explained by the fact that most of them do not have any tradition of farming. They migrated into the highlands simply to escape unemployment and survive. It is significant that 80 percent of the "upland swiddeners" occupy the land illegally.

Most of these migrant farmers consume the greater part of their own produce, selling any surplus in the market for a few cents. During the harvest they enjoy a brief period of self-sufficiency, but during the off-season

they have to spend up to 80 percent of their budget on food.

"Our standard of living scarcely improves at all" is what most migrants say. "We can't set aside the money we need to make improvements or invest in something more profitable." In the past, one hectare (ha) provided enough to feed an average family; now they have to cultivate four 1.5 ha plots to eat. If the peasants hope to survive, they have no choice but to clear new plots constantly, which perpetuates the cycle of poverty.

The Silliman University study showed the need for an agroforestry program designed to avert the ecological and economic catastrophes that accompany the deforestation of the mountain slopes and to secure an adequate food supply for the Filipinos. Reforestation and soil restoration must be integrated with the process of clearing and farming the uplands, Mr Cadelina says.

Clearing the wooded slopes must be strictly regulated, he adds, so as to oblige peasants to respect the environment and plant trees. It should be the responsibility of the government to determine which land may be farmed, to restrict the size of lots, and to reforest some of the land.

"Protecting the natural environment and the ecosystem is the business of everybody, including the government and those who use the land," says Mr Cadelina who would also like to see training and educational programs set up for the peasants.

SOCIAL COSTS

The second phase of the Silliman University study, currently in progress, will attempt to shed light on the social repercussions of migration into the uplands.

"At first glance it looks as if these itinerant slash-and-burn farmers get some financial advantage, but at what price do they get it?" asks Virginia Disco, who is leading this part of the study. "What effect does this constant migration have upon marriages and family and social life? What does it do to the women and children? Don't these endless wanderings further harm the prospects for the younger generation which already has little to hope for?"

Although it isn't yet possible to give accurate answers, Miss Disco has raised a number of issues that directly affect the welfare and living conditions of these people. The problems include the geographical isolation brought about by the absence of passable roads and communal transportation, and the inaccessibility of health services, education and social resources. □

Denis Marchand is a Canadian freelance journalist who visited Asia on a project organized by the Fédération professionnelle des journalistes du Québec, funded by the Canadian International Development Agency.



Ecologically sound cultivation: Filipina peasants sow a food crop between two rows of ipil-ipil.

IPII-IPIL: MOUNTAIN MARVEL

By DENIS MARCHAND

More than three thousand years ago the Ifugao tribes constructed astonishing rice terraces on the steep slopes of the northern Philippine mountains. Held up by stone walls, the terraces are still solid and practical, a proof of the agricultural wonders that can be worked on land thought to be useless for farming.

However, one has to know how to go about it. All too often, highland farmers encounter numerous problems of subsistence because they use old-fashioned agricultural techniques that degrade the soil. They end up working very hard to produce very little.

The Mindanao Centre for Rural Life in the southern part of the Philippine archipelago is keenly aware of the difficulties of these poor people. Since 1978 it has been carrying on an agroforestry program designed to increase the agricultural output of cultivated slopes and, at the same time, reduce the catastrophic effects of soil erosion. The main architect of the program, Father Harold Watson, an American, decided he would find a new cropping technology suitable for sloping land and then train small farmers so that

they could meet their own needs for food and income.

MULTIPURPOSE LEUCAENA

The first thing Father Watson did was to buy 35 hectares (ha) of land on the mountainside. He then tested several intercropping systems which had been tried in Hawaii and at the University of Los Baños in the Philippines. One type of tree he used was *leucaena leucocephala*, famous for its many uses.

The cropping system Father Watson developed, called Sloping Agricultural Land Technology (SALT), has been highly successful and is now the most advanced agroforestry program in the Philippine archipelago. Its linking of reforestation with farming is essentially based on the use of *leucaena*, commonly known as ipil-ipil in the Philippines.

This tropical tree grows very fast, often attaining a height of 4 m in its first year. It provides fuelwood, construction material, fence

posts, protein-rich forage for cattle and, above all, organic fertilizer for crops. It is easy to plant and will grow in almost any kind of soil. The first pods appear in less than four months and these can be used to grow new trees.

The technique developed by Father Watson makes it possible to reforest the bare mountainsides and leave enough clear space for subsistence crops. Ipil-ipil is particularly suited to such crops because it improves the yield and fertility of the soil. Its roots, which penetrate deep into the earth, draw nutritional elements to the surface and its leaves, because they decompose rapidly, supply abundant and cheap organic fertilizer.

The SALT method is to plant trees close together to form double hedges along the contours of the hillsides at intervals of roughly 7 to 10 m from the bottom to the top of the slope. These rows of *leucaena* mark out the areas which can be cultivated and also constitute barriers to erosion which eventually become genuine retaining walls. In effect, natural terraces are formed.

The rows of ipil-ipil not only prevent the soil from moving but also dam up earth from higher levels, particularly if two rows of trees are planted close together and the space between them is filled with rocks, branches, and crop residues.

"The principle of SALT is the same as that used by the Ifuagao tribes three thousand years ago," says Warlito Laguignon, an officer at the Centre for Rural Life. "All we are doing is suggesting using leucaena trees instead of rocks."

The technology envisaged by the Centre still requires careful management of the space between the rows of trees. They recommend that the combination of permanent, semi-permanent, and annual crops be balanced so as to rebuild the ecosystem and maximize yields while enabling farmers to organize their work time efficiently.

In most hillside farming systems, one finds a mix of fruit trees, cereals, and vegetables. Every third strip of available land is normally devoted to permanent fruit trees. These will produce an annual crop of bananas, lemons, papaya, coffee, or cocoa. Their presence in such systems is most important because their roots stabilize and thicken the ground cover, so that it is not washed away during the rainy season. Their leaves also serve to prevent the soil from being blown away by the wind or drying out and provide the ideal climatic environment for growing vegetables.

CROP ROTATION

The Centre suggests that farmers plant a combination of different cereals and vegetables on the remaining two strips of land. Each should have its own specific area so that there can be a seasonal rotation. The regular rotation of crops is considered very important. It helps to preserve the regenerative properties of the soil and avoid the problems of infertility typical of traditional agricultural practices.

This system of mountainside polyculture guarantees farmers a regular income and a reliable, year-round food supply. It also provides them with the full range of proteins, vitamins, and minerals essential to a healthy diet. According to Mr Laguignon, harvesting pineapples, ginger, soybeans, peanuts, corn, rice, melons, yams, sorghum, tomatoes, eggplant, squash, sweet potatoes, and cucumbers enables farmers to increase their incomes by anywhere from double to 18 times what they earned before. At the same time, it provides new means of subsistence.

"This system of agroforestry offers many valuable ecological advantages," says Mr Laguignon. "It greatly reduces the risk of drought, landslides, floods, the silting over of low-lying land, and wind erosion, all of which are linked to the radical transformation of the natural environment and the destruction of the mountain forests. It also



Photo: Denis Marchand

Remnants of a maize crop. Leucaena hedges promote the formation of natural terraces.

replaces ugly eroded and denuded slopes with the luxuriant beauty of abundant vegetation."

The Mindanao Centre for Rural Life was established to develop a practical and efficient system for farming the slopes. It rapidly became a highly respected model farm and Father Watson's methods are taught 'on the job'. The training of farmers was one of the major objectives of its founder right from the start.

This system of mountain-side polyculture guarantees farmers a regular income and a reliable, year-round food supply.

"The farmers of this area need training, technical guidance, and a degree of organization before they dare to try a new technique which, to them, seems revolutionary. Without proper training these people will only change their habits very slowly," says Mr Laguignon. "Our model farm was designed quite specifically for the purpose of passing on knowledge in a practical and realistic way, so that the farmers of the region can truly participate in national agricultural and economic development." He says that it isn't enough simply to talk about appropriate technology; the most important thing is

to train people so that they know how to use the technology to manage and organize their farms in a productive way.

VISITORS WITH A COMMON PURPOSE

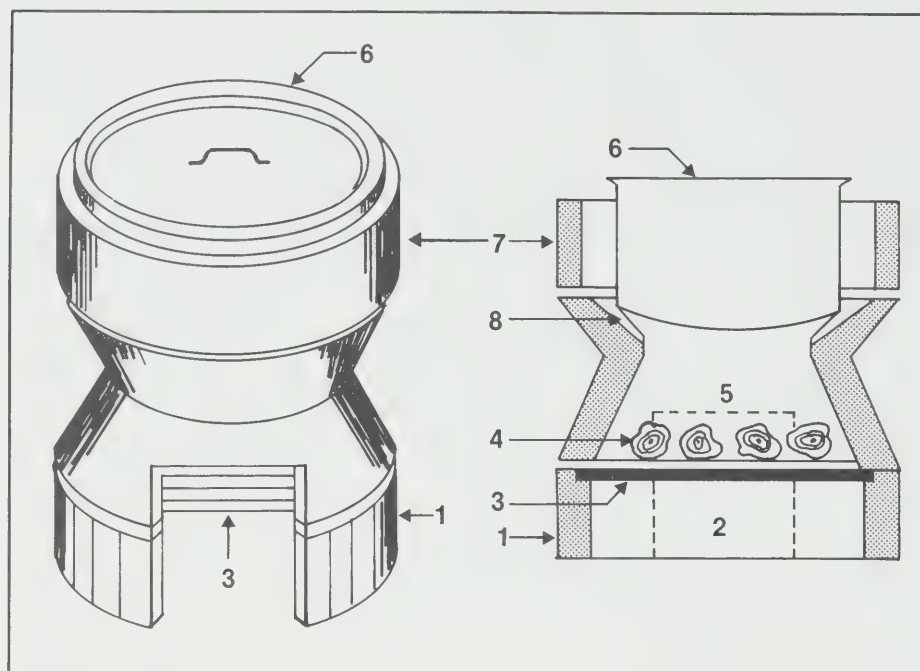
The peasants aren't the only ones who regularly go to Father Watson's Centre. Numerous agricultural technicians, researchers, and development workers from Thailand, Indonesia, Nepal, Japan, and the African countries take the mountain trail which leads to the farm. They all go there with the same purpose: to find a way of adapting this technology to the specific conditions in their countries.

In addition to all these visitors, many Philippine officials and agronomists come to seek answers to one of the country's thorniest problems—hunger. "If a part of the population goes hungry, it is because too many farmers make poor use of the land and only bring in meager harvests," says an official of the Philippine Ministry of Human Resources. "It may turn out that Father Watson's system for raising crops on slopes is the right answer because it is so simple and easy to use. But how long will it take for it to spread to all the regions of the Philippines?" □

Denis Marchand is a Canadian freelance journalist who visited Asia on a project of the Fédération professionnelle des journalistes du Québec, funded by the Canadian International Development Agency.

COOKING THE CHULHA WAY

IMPROVED FUELWOOD EFFICIENCY



Damru Chulha: 1) ash-pit construction; 2) ash-pit window; 3) grate; 4) fuelwood; 5) fuel-charging window; 6) cooking vessel; 7) heat shield; 8) 3 ribs to support vessel.

By PRAVIN KUMAR

Wood is by far the most important fuel in the Third World. In fact, per capita consumption is 3.5 times higher than in the industrialized countries.

In India, the rural poor depend on fuelwood felled or collected from the forests. It often takes a day's hard trekking to collect enough wood for the next day's cooking. The country's annual requirement of fuelwood is estimated at 256 million m³, or about 16 percent of the world total.

Indiscriminate felling of forests for fuelwood has reduced the forest cover, leading to soil erosion, flash floods, and silting of dams. Any means of conserving fuelwood, therefore, will not only be a boost to the family household, but also indirectly ward off the side effects of forest destruction.

Fuelwood can easily be conserved by means of more efficient wood-burning cookstoves. In many cases, existing cookstoves need only a minor improvement for better performance. For example, it may be possible to redirect the flow of air and hot gas through the stove to concentrate more heat on the cooking surface. A chimney can improve efficiency by providing draught, the motive power that provides air for combustion. Alternatively, the cooking vessel can be arranged to fit the stove tightly, preventing heat leaks.

These factors have been taken into account in the design of two cookstoves developed at the Agricultural Tools Research Centre, in Bardoli, Gujarat State. One is the

shielded, light-weight family-size model, the "Damru Chulha"; the other is the "Community Chulha". According to Rahul Parikh, a research engineer at the Centre, a saving of 30 to 50 percent in fuel is achieved by users of the chulhas. As of February 1986, more than 10 000 Damru Chulhas had been constructed and introduced in Gujarat villages.

DOUBLE CONICAL SHAPE

The tapered shape of the Damru Chulha, originally suggested by a social worker, is similar to that of the cooling towers of thermal power stations. The draught of air is increased by the double conical shape of the cookstove's inside. The outside can be double conical, with walls of uniform thickness, or cylindrical. The chulha is made of clay with certain additives to prevent cracking and to give better binding capacity and porosity. It can be made to be portable or can be mud-plastered to the kitchen floor. The cost is Rs 37 (approximately CA \$4).

The Damru Chulha is so simple in design that it can be produced by local potters or other villagers who make traditional stoves. Sheet iron or wooden moulds can be used to produce the inside shape. The Chulha body and the shield for the cooking vessel are moulded separately. While the body may or may not be of fired clay, the shield should be fired.

Combustion has been improved by

means of an iron grate on which the fuel is loaded. Air enters from under the grate and passes through the fuel bed. Because of the thorough mixing of air and fuel, combustion of volatile gases begins even before they enter the space above the fuel bed. Thus, even without a chimney, the grate and double conical shape make for better combustion in the Damru Chulha. There is smoke only when the fire is first lighted.

To prevent heat losses, which can be very high when there is wind, a clay ring is used to shield the cooking vessel.

A series of water boiling tests with the Damru Chulha gave a standard consumption of 700 to 900 g of dry wood equivalent per litre of water evaporated. It takes 20 minutes to boil 3.5 L of water. This compares well with gas fuel which takes 6.5 minutes per litre of water.

For community kitchens, two models of the Community Chulha—one for boiling and the other for cooking chapatis (wheat cakes) and frying—have been developed by the Agricultural Tools Research Centre. Like conventional chulhas, these are made from sand-and-clay bricks. Their main features are: a fuelwood grate; a window for fuel charging, equipped with a damper; an ash-pit window for air intake and ash removal, also equipped with a damper; and two or more layers of bricks to shield the vessel.

ALMOST NO SMOKE

The fuelwood pieces used in the Community models should be as small as possible so that the optimum combustion temperature, between 250°C and 500°C, can be attained quickly.

Water boiling tests for the Community Chulhas showed a standard consumption of 500 to 800 g of dry wood equivalent per litre of water evaporated. It takes about 32 minutes to boil 25 L of water.

The Community Chulha has been adopted by more than 100 educational and other institutions in Gujarat. The design of the Damru Chulha has been adopted by the Forest Conservation Department of Gujarat State and some voluntary and rural development institutions in Gujarat. It was also approved last year by the Government of India's Department of Non-Conventional Energy Sources for demonstration and construction throughout the country. □

Pravin Kumar is a freelance science writer based in Bombay, India.

For more information on the Damru and Community Chulha stoves, contact: Agricultural Tools Research Centre Suruchi Campus Post Box 4 Bardoli 394601 Gujarat, India

THE HOUSING CRUNCH

By DEOGRATIAS BYABAFUMU

A retired industrial worker in his eighties crawls out of a hovel built with polythene, scrap metal, and cardboard to stretch out his weak limbs in the sun. In his lap is his only company—a 4-year-old granddaughter left by his daughter whom he has not seen for a long time. The two survive on meals of black tea and maize flour bread.

The picture is a daily sight in the slums of many African cities which are ringed by the rejected and sickly poor, many of whom left their rural homes when young and have since lost their roots there. The challenge of finding shelter for the urban populations of African and other Third World countries is becoming greater than ever before.

The UN has declared this year, 1987, the International Year of Shelter for the Homeless. In March 1986, at a meeting in Nairobi sponsored by the Government of Finland, several East African countries came to grips with the problems of insufficient housing and basic amenities such as water and sanitation. Uganda, Tanzania, Kenya, Sudan, Somalia, and others disclosed their lack of capital and technical personnel to put up sewers, housing, piped water systems, and roads for most of their people.

While most of the countries at the meeting agreed they have small urban populations compared with other Third World countries such as Mexico and India, they said that overcrowded slums are taking their toll on women and small children since disease is likely to increase in such conditions. What

is more frightening, according to several delegates, is that urban population growth rates are shooting up fast, with most countries' rates now between 4 and 9 percent.

Ethiopia is a rural country, with only 11 percent of its 38 million people living in cities and towns. All the same, says Shitto Mersha, a delegate to the conference, the organizational and technological base of agriculture, the backbone of the country, is weak as it cannot support the food needs of the farming population. Furthermore, most peasants live and work in isolated areas far from services, and access to sanitation and safe water is lacking.

Overcrowded slums are taking their toll on women and small children since disease is likely to increase in such conditions.

In a survey carried out in 17 major urban centres in Ethiopia, it was shown that access to water was unsatisfactory although much better than in rural areas. In the 318 urban centres in the country, about 60 percent of the population had no access to such facilities.

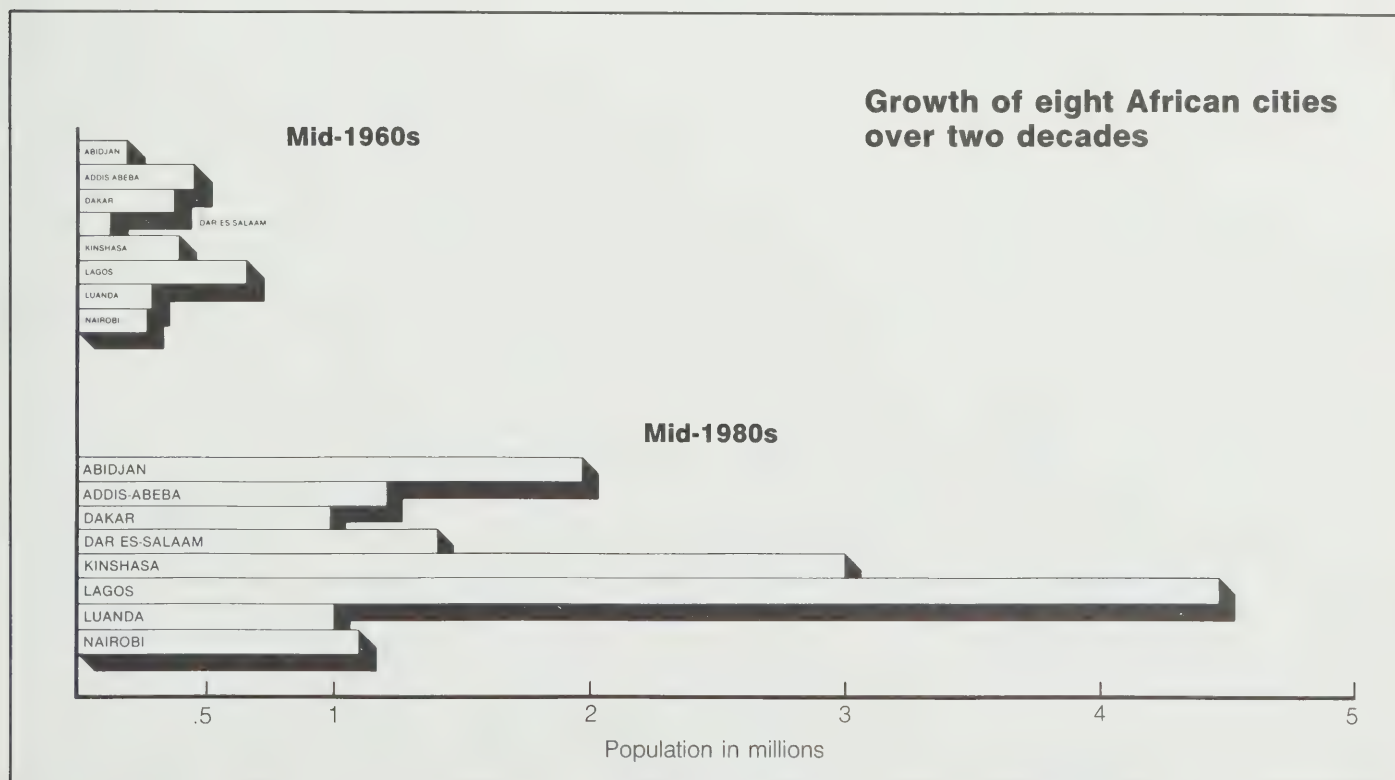
As in several other African countries, the organization and use of urban land in Ethiopia are wanting and urban centres suffer from a weak economic base.

In Tanzania, things are no better. The population is about 21 million people, 15 percent of whom live in urban centres. Mr B.K. Majani, project manager of Tanzania's National Sites and Services Project, told the conference that the high rate of growth in urban centres in the country indicates that cities serve more as centres of refuge than of production. His worry is that cities are becoming more parasitic than productive in overall national development.

Most housing in the country is built by self-help efforts. There is little institutional housing in urban centres in Tanzania and government investment in public housing has been minimal of late. The capital city, Dar es Salaam, which means 'city of peace', has chronic problems with its water system.

In neighboring Uganda, where political instability has undermined economic development, the housing shortage in 1986 was 100 000 units. The country has a major problem with the durability and quality of housing in rural areas because insect pests attack wooden construction materials. Furthermore, staggering inflation has made it impossible for most poor Ugandans to buy building materials.

In 1983, according to the World Health Organization (WHO), only about 57 percent of East Africa's urban and 29 percent of rural areas had access to safe water. In urban



SERVICING

THE CASE OF

centres, water supply has been outpaced by the demands of a growing population, resulting in interruptions of service.

According to WHO, sanitation coverage in urban and rural areas of East Africa average 55 and 18 percent respectively. And while water-based sewage systems serve small areas of large cities and towns, they are poorly operated and often out of order.

VILLAGIZATION PROGRAM

East African countries have taken various measures to provide housing and improve services. When the socialist government of President Mengistu took power in Ethiopia, for example, it used mass mobilization and participation to construct housing.

About half a million peasants in Ethiopia were recently moved from the overworked land in the northeastern areas to the more

order to adapt and use local materials. In fact, some mud-and-wattle houses—but with iron roofs—are being tolerated in the slums near Nairobi, where raging fires have often ruined the shacks of many poor people.

COSTLY BUILDING MATERIALS

A major constraint still facing developing countries is the rising cost of building materials. It is one of the "chronic problems hindering successful implementation of shelter programs in Tanzania", according to Mr Majani.

Many Third World countries import about three-fifths of their materials used for official construction, which is between 5 and 8 percent of their national imports. This is a great drain on financial resources. While the average Northern European worker in the late 1970s could, for example, buy 10 bags of cement with a day's wages, according to the Worldwatch Institute, a rural African worker needed 10 days' wages to buy the same. Furthermore, the cost of transporting cement over 100 km can exceed the cost of production—as in Botswana and Sudan, for example. Retired Tanzanian President Julius Nyerere, a frugal man, once referred to the addiction to the use of cement in construction as a mental paralysis that impeded development and improvement in housing quality by absorbing badly needed capital.

The use of inexpensive local materials is an attractive alternative. In fact, architects now argue that some concrete housing is not suitable for the hot climates of Africa.

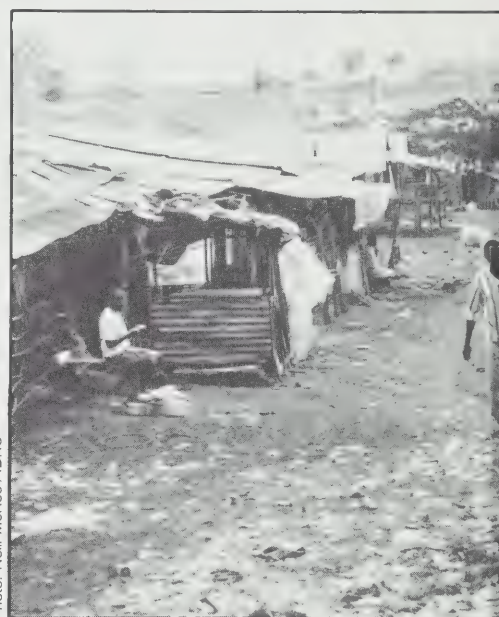
'ASFADOBE' BRICKS

One inexpensive and durable building material is mother earth. It can be mixed with a little asphalt and pressed with simple technology to make "asfado" bricks. In Sudan, these can be produced for a fifth of the price of cement blocks.

In the years to come, housing the poor will continue to be a major challenge for several African countries. There is no indication that the rising tide of migrants to the cities will soon ebb, and theories about urban numbers going down when rural migrants realize there are no jobs in the cities do not seem valid.

There are now over 800 million people in the world living in poorly built dwellings and squatter settlements. In their attempts to cope with this unfortunate predicament, governments must work out sound housing policies that will promote the use of local resources and skills in providing decent shelter for the poor. □

Deogratias Byabafumu is a Ugandan freelance journalist working in Nairobi.



A Kenyan shantytown. African governments are looking for solutions.

By LYSE DOUCET

In 1912, Abidjan was a tiny French colonial post with 1400 inhabitants. Its population grew slowly. Eventually the railway line opened, traders set up shop, and the city became the capital of Ivory Coast.

Beginning in the 1950s, Abidjan is said to have undergone a "demographic explosion unprecedented in the short urban history of French-speaking West Africa". Today the city has a population of almost two million and is still growing. Abidjan is referred to by the French as "little Paris" and Americans say it resembles Manhattan. But it has not been the only African city to grow so fast.

Lagos, Nigeria, for example, is a bustling metropolis of more than four million people. It is a veritable magnet for hundreds of thousands of West Africans who see it as the city in which to hustle for money—in trading, services, and the vibrant informal sector. Other burgeoning African cities include Nairobi, Lusaka, Dar es Salaam, Kinshasa, and Douala.

URBAN DECAY

Africa has the highest population growth rate of all the continents and its cities have expanded faster than most governments' capacity for maintaining a satisfactory level of urban services. Workers in need of affordable housing are obliged to live outside city centres, often in slums, and without adequate urban transportation they find it difficult to get to work. To make matters worse, poor sanitation and insufficient access to clean water lead to sickness and urban decay.

"Small-scale incremental housing holds out the most promise for spurring direct and indirect employment creation in poor countries."

remote, but fertile regions. Another measure has been a mass villagization program. The most populous administrative region in the country, for example, is planning to set up 7735 villages and over two million housing units in the next few years.

In July 1975, shortly after the nationalization of rural land, all urban land and extra houses were also declared public property and compensation was paid to owners. Rent reductions of up to 50 percent were imposed and there have been no rent increases in the last 10 years. Urban dwellers have been encouraged to form cooperatives in order to build homes cheaply. The government is to assist them with technical personnel and loans given at concessionary interest rates.

FINANCING AND SECURITY OF TENURE

Two specialists from the Nairobi-based UN Centre for Human Settlements recommend that local governments supervise land management and infrastructure development programs and that the poor be given security of tenure and access to financing. "If employment is the key goal," they add, "then small-scale incremental housing holds out the most promise for spurring direct and indirect employment creation in poor countries." They also encourage the tolerance of revised minimum building codes and standards of housing which the poor can meet.

Kenya has already taken the lead in altering its restrictive building by-laws in

AFRICA'S CITIES

ABIDJAN



ways to clean up their cities.

When African governments and urban planners began to ask questions about how to improve urban management and, more urgently, to find new sources of funds, it became obvious that little research had been done in this area. Africans also knew little about how their neighbouring capital cities were coping.

The need for a comparative study of urban problems was emphasized during a seminar in Nairobi in 1982 organized by the University of Toronto's Institute for Environmental Studies and the Stockholm International Federation of Institutes of Advanced Studies. Research teams from seven Francophone and Anglophone African countries—Ivory Coast, Senegal, Zaïre, Kenya, Tanzania, Sudan, and Nigeria—submitted proposals to IDRC which agreed to finance a research project to be coordinated through the University of Toronto.

Each team is responsible for two studies: an analysis of the "urban crisis" in their country's major cities, and a more in-depth study of a particular urban problem, be it transport, low-cost housing, financial management, or water and electricity supply.

The effort is "unique", says Ivorian project leader Dr Attahi Koffi, a geographer and urban specialist at the University of Abidjan's Center for Urban and Architectural Research (CRAU). Aside from a general study of urbanization in Abidjan and other large Ivorian cities, the Ivorian team has been examining the issues of municipal reform and local financing.

Forty-four percent of Ivory Coast's nearly 10 million people live in urban areas. While that percentage does not place it in the ranks of the most highly urbanized nations, the

Ivorian study points out that problems of urbanization are becoming more and more difficult to solve. Abidjan's population of two million is growing by 10.5 percent a year while smaller cities in the interior are expanding at 7.8 percent. The figure for rural areas is only about 2.3 percent.

HOUSING SHORTAGE

Abidjan suffers from a lack of schools, hospitals, and other services for the majority, low-income African population. The housing shortage too is serious—a reality confirmed by a separate IDRC-funded study on low-cost housing in Ivory Coast. "The Ivorian government has done a great deal, much more than most African states, to provide low-cost housing," says Marcel Djamat, director of CRAU, and leader of that earlier housing study. But he says that the government could still have done more and done it better.

While there were "good intentions" to begin with, Djamat explains, the state housing corporations have suffered from poor management and inappropriate personnel. The weaknesses were recently confirmed when the government announced it would be dissolving SOGEFIHA, its state housing agency, and selling off its properties.

Ivory Coast's state housing agencies, with some assistance from a private company, constructed 45 000 housing units between 1970 and 1980. But the Ivorian Government has announced that it is no longer building, although Abidjan needs about 25 000 new units each year to cope with the influx of new arrivals, both Ivorians and other Africans.

ACCESS TO LAND, LOW-COST LOANS

"The spread of shantytowns will become a serious problem if there is no more construction," says Djamat. He emphasizes the importance of improving access to land and low-cost loans to encourage private companies or local people themselves to build. The Ivorian Government has said it will become involved in these areas and financial institutions such as the World Bank are investing in the low-cost housing sector.

One solution that emerged from Djamat's study was for municipal councils to fill the gap left by the Ivorian Government.

In 1980, Ivory Coast embarked on a decentralization program to give more responsibilities and fiscal powers to municipalities. In 1985, the number of municipalities increased from 37 to 135. Despite continuing financial and administrative problems, United Nations officials say Ivory Coast's efforts to decentralize are the most advanced in the region.

Some municipal councils have begun to tackle pressing problems such as the threat of shantytowns. In the wealthy Cocody area of Abidjan, the municipal council helped to

clean up one shantytown. And in the more densely populated, low-income areas of Port Bouët and Youpougon, the local council established what Djamat described as a "modern shantytown". The houses are the usual haphazardly constructed dwellings but the site was planned and provided with electricity, water, and sanitation facilities.

Municipal action will, however, be hampered by many councils' lack of financial resources and technical expertise. The Ivory Coast's wider urban report emphasized the need for a "more audacious system of municipal fiscal policy which would give a class of urban administrators the means to solve their administrative problems." Taxing powers and licences are two tools.

'HUMANIZED' HOUSING

Tackling the "urban crisis" will be no easy task. But the value of the research reports will be to indicate what lessons can be learned from government efforts to date. Djamat's housing study, for example, emphasizes that housing itself is only part of what families need to improve their standard of living. Some low-cost housing has been built in areas with no schools, post offices, or access to vital services. And the monotonous architectural style of many houses is at odds with the "African way of life". People have added rooms, extra floors, or exterior decorations to adapt their dwellings to their tastes and needs. And given that more than half of the families in Abidjan's low-income districts have 5 to 10 members, many of the state's housing units are just not large enough. Housing, says Djamat, must be "humanized" so that people are not condemned to live in "rabbit cages".

The housing study also underlines the importance of allowing people to buy their own homes eventually instead of continually renting as has been the case in state housing.

Ivorian President Félix Houphouët-Boigny vowed in 1965 that in 10 years, "there will not be a single shack in Ivory Coast." But in spite of commendable government efforts, Abidjan's low-income residents, many of whom are non-Ivorians, are having to resort to "taudis" or "poto-poto" (houses in the mud).

The Ivorian study on low-cost housing asks whether, given the scale of urbanization, it is possible to cope with the problems. It and the other urban studies financed by IDRC indicate there are various measures to be explored. Research teams from across Africa have discovered they have urban problems in common. Their next task is to find out whether they can also share their solutions. □

Lyse Doucet is a Canadian freelance journalist based in Abidjan.



MOULDING THE URBAN

By FRANÇOIS BÉLISLE

In the developing world, cities are growing twice as fast as the overall population. Jobs are scarce, there is a critical shortage of decent housing, and urban services strain under the load of growing demand.

In such difficult circumstances, it is crucial for urban planners, politicians, and administrators to have up-to-date social and technical information on which to base their

policy decisions. The future shape and texture of the world's cities depend on the decisions taken today by these "architects".

Should new roads be built, or should scarce funds be spent on upgrading an aging water supply system? What's the best way to finance a new housing scheme and what role should the municipal government play? Is it preferable to encourage traditional transport modes or to replace them with modern ones? Urban policymakers all ask themselves these and similar questions, but unfortunately there are as many answers as

there are cities. Solutions to pressing urban problems must be tailored to each city's needs and resources.

Complicating the urban equation is the fact that a large portion of urban growth is totally unplanned. With the rapid influx of rural migrants, new shantytowns sometimes spring up in a matter of days or weeks. The researchers who gather and analyze urban data need not only fast reflexes but also flexible scientific methodologies.

The Urban Policy Program of IDRC's Social Sciences Division has supported



Top, left to right: Selling flowers on the street is part of the bustling informal economy of Puerto Plata, Dominican Republic. In Jakarta, Indonesia, prefabricated apartments are assembled. Next, a white cluster of low-cost houses adds a measure of geometric design to a Venezuelan hillside.

Bottom: A three-wheeled taxi in Manila, the Philippines. A variety of transportation modes help Third World cities to cope with huge numbers of people on the go. In a suburb of Dakar, Senegal, low-cost housing is built on serviced lots. In north-eastern Brazil, a crude shack contrasts sharply with a neat housing development in the background. Photos by François Bélisle and Neill McKee.

LANDSCAPE

urban research since 1980. It has three areas of concentration: informal sector enterprises, the management of urban growth and services, and helping the poor to fill such basic needs as shelter. The program pays special attention to those countries that need to improve their urban research skills.

The informal sector refers to a multitude of normally unregulated economic activities—from selling tamales on the street, to making shoes out of old car tires, to running a rickshaw business. IDRC-supported research in this area aims to understand how

the sector works, to improve job opportunities through training and credit, and to monitor the impact of policies on people's incomes and working conditions.

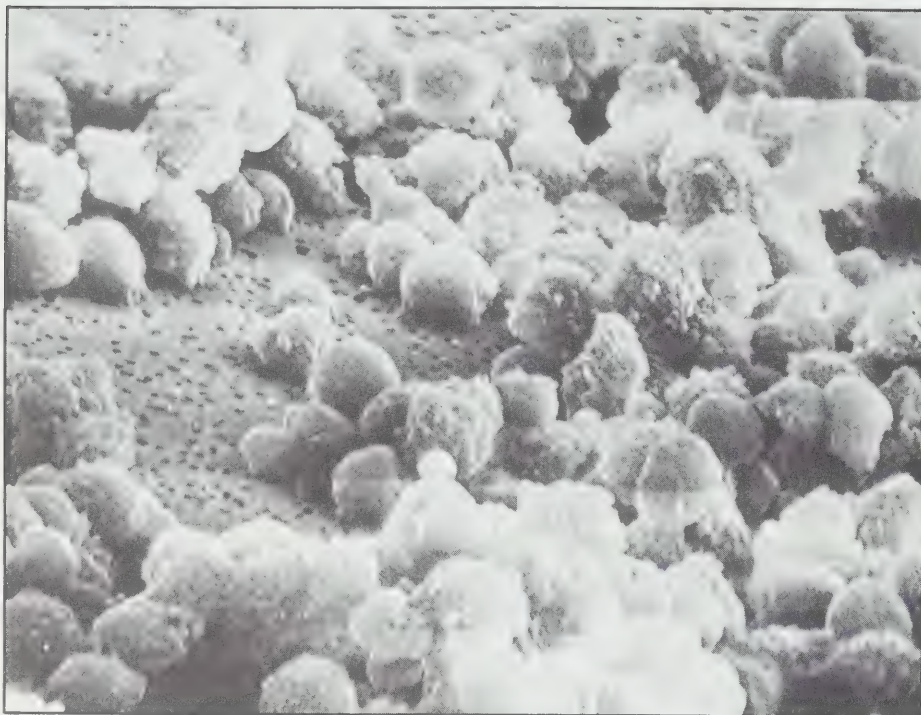
Researchers studying the management of urban growth and services assist public institutions in analyzing the impact of their policies and in improving the delivery of services. Given the severe budget constraints on Third World governments, minimizing costs and encouraging the poor to participate in the provision of services are high IDRC priorities.

As 1987 is the International Year of Shelter for the Homeless, research on shelter-related issues will be particularly timely. For example, the Urban Policy Program will support studies this year on housing cooperatives and financing mechanisms. It will also assist researchers in finding ways to improve access by the poor to food and fuel. □

François Bélisle is Senior Program Officer in IDRC's Urban Policy Program.

A DEADLY SHADOW

AIDS IN AFRICA



Scanning electron microscope image of HIV virus that causes AIDS.

By AMY CHOUINARD

Acquired immunodeficiency syndrome (AIDS), also called "slim disease" in Africa, has spread quietly across that continent in a belt that grows wider as the victims waste away.

No one yet knows how AIDS began. In the industrialized North, some people pointed first at Haiti, then Zaire, Central African Republic, Rwanda, even Uganda. They alleged that the AIDS virus (human immunodeficiency virus, or HIV) was transferred from African apes since a simian virus has been shown to be similar. The response was that some American sailor introduced the virus to Africa, as about 80 percent of the cases reported to date to the World Health Organization have been in the United States.

In both the North and the South, most of the people now studying the virus are not pointing fingers. Rather, they have joined forces to try to control the epidemic.

In Africa, AIDS affects men and women in roughly equal numbers (60 and 40 percent of cases respectively). In North America (up to 1986), about 90 percent of the cases have been homosexual and bisexual men, and 10 percent have been intravenous drug users, recipients of transfusions, sexual contacts of infected bisexual men, and babies born to infected mothers. According to three doctors at the University of Manitoba in Canada, however, the North American picture is likely to change, with women increasingly becoming infected.

Since 1979, the three Canadians have been working with scientists at Kenya's

University of Nairobi. Dr Allan Ronald, who heads the department of medicine at the University of Manitoba, and two of his colleagues, Drs G.W. Hammond and Frank Plummer, reported their findings to the Canadian Medical Association in August 1986. They said the virus causing AIDS is transmitted in three ways. The main route is direct sexual contact, specifically genital-genital intercourse and receptive anal intercourse.

INFECTION OF NEWBORNS

A second route is perinatal transmission, that is from infected mother to newborn. In such cases, the transmission risk can be as high as 50 percent. According to Dr Ronald, it is not yet clear what the relative infection risks are for the child at various stages: while in the womb, during birth, and during breast feeding. It appears, however, that the risk of infection is high during the actual birth.

It is also known that AIDS-infected mothers have high viral counts in their breast milk, but exactly what threat this is to the feeding child is unknown. In some hospitals in East Africa, breast milk is pooled by 40 to 50 mothers to nourish newborns whose mothers have trouble nursing. If the risk of infection from breast milk turns out to be high, such practices may have to be altered as has been the case with blood banks. Dr Ronald stresses, however, that the practice of breast feeding is far too important to

child health, especially in developing countries, to be stopped because of unsubstantiated fears.

Thirdly, AIDS can be transmitted parenterally, that is, from contaminated needles used in intravenous injections and from transfusions.

PROSTITUTES ARE HIGH-RISK GROUP

In Africa, heterosexual intercourse is by far the most common route of infection, with prostitutes considered to be a high-risk group. But the virus has been slow to move into the heterosexual population in North America. The spread of the disease from AIDS victims to their spouses, for example, is slower at present than in Africa. Why? The answer is a key piece of information still missing from the epidemiologic puzzle.

According to Dr Plummer, who now spends 10 months of the year in Nairobi, the findings of his group and those of others indicate that the surface glycoproteins (the envelope) of the AIDS virus are highly variable, while the core protein of the virus is the same throughout the world. Envelopes of AIDS viruses isolated in Zaire and Kenya, for example, have been observed to be markedly different. According to Dr Ronald, the ability of the AIDS virus to alter its envelope is some 100 times greater than that of another highly variable virus, influenza A. Vaccines are designed to induce the human body to mount its own natural defence against specific diseases. But to be effective the body's immune system must have a consistently recognizable target on the virus to attack. Envelope variability, then, constitutes

In Africa, heterosexual intercourse is by far the most common route of infection, with prostitutes considered to be a high-risk group.

a hurdle to the development of an effective AIDS vaccine.

Although its origin is still uncertain, clearly the AIDS virus is new in Africa and the prognosis for those infected with it appears as bleak as for their counterparts in North America. Within the AIDS belt across Africa, for every million Africans aged 16-45 years, 50 000 to 150 000 (5 to 15 percent) will suffer from AIDS within five years, according to Dr Plummer. The toll in suffering and death will be enormous.

Kenya was the first country in Africa to acknowledge officially the presence of AIDS, reporting cases to the World Health Organization, introducing a national policy aimed at preventing the spread of the disease, and

setting up an AIDS committee for control and investigation.

The AIDS research at the University of Nairobi is part of a larger project on sexually transmitted diseases (STDs), the sixth largest public health problem in Kenya and other countries of sub-Saharan Africa. The Kenyan government provides the bulk of the financing, with IDRC funding part of the Kenyans' work and part of the Canadians'. The Canadian team also receives funds from the Medical Research Council of Canada (MRC) and the Canadian International Development Agency.

CONSULTATION WITH CANADIANS

The Kenya-Canada collaboration began with a study of genital ulcers in conjunction with the microbiology department of the University of Nairobi. It has since expanded to include all sexually transmitted diseases, involving personnel from the Kenya Medical Research Institute, the Nairobi department of health, and the Kenyan Ministry of Health.

Elizabeth Ngugi, the country's Chief Nurse, assists the research team. Since 1982, she has been devoting half a day each week to the battle against STDs, organizing a group of about 600 prostitutes to minimize their health risks. (Nairobi has an estimated 5000 to 8000 prostitutes.)

The research group has been working in four or five clinics, treating and advising patients as well as collecting samples of blood and genital smears. The clinics are mainly for maternal and child health, but one deals specifically with STDs.

The results of sample analyses document clearly the introduction of the AIDS virus and its spread among prostitutes in Nairobi. The data from men attending the STD clinic show that a past history of chancroid is closely associated with the virus.

Of blood samples collected from prostitutes in 1981, six percent showed evidence of infection. By 1984, the figure had jumped to 65 percent. In 1981, no evidence of the virus was found in blood from women in labour in Nairobi. In 1985, two percent of 1000 women in labour showed signs of infection.

Detecting the AIDS virus itself is difficult and expensive. Fortunately, there is a less sophisticated test available that detects AIDS-specific antibodies in the blood. The presence of these signals that an individual has been infected.

The time lag between exposure to the AIDS virus and development of the AIDS antibodies is uncertain, but estimates are that some individuals may be infectious for up to three months before they test positive.

It is also uncertain what proportion of infected people (i.e., those in whom AIDS antibodies are present) will later exhibit signs and symptoms related to AIDS. Epidemiologic data from follow-up tests on the infected Nairobi prostitutes a year later revealed that

four percent had signs of AIDS or AIDS-related complex (ARC)—for example, persistent shingles. In the USA and Canada where epidemiologic data have been collected longer, 25 percent of infected people exhibit symptoms of AIDS or ARC within five years.

INTERNATIONAL PESSIMISM

According to Dr Ronald, the best information from the international meeting held in Paris in June 1986 led to pessimism. "There is no evidence that, if people become infected but live for a number of years without symptoms, they won't eventually die of the disease," said Dr Ronald. "The consensus was that all infected individuals will eventually die of AIDS. Once the signs of the disease have emerged most people die within two years."

Reports of the epidemic elsewhere in Africa are alarming. In studies in Zambia and Uganda, AIDS antibodies were detected in as many as 14 percent of pregnant women tested. In Kinshasa, Zaire, seven percent of 24 000 hospital workers had the antibodies, and in Rwanda, 18 percent of blood donors (45 percent of rural donors) were likewise infected.

The consensus at the Paris meeting was that all infected individuals will eventually die of AIDS.

Overall in North America the ratio of male to female victims is 13:1. In a screening of 300 000 personnel in the U.S. armed forces, the ratio was 1.5 to 1. The armed forces study has been criticized because it did not control for cases in which the victims were users of intravenously administered drugs. It does, however, provide strong evidence that the worst predictions about AIDS are true—any man or woman who has sex with multiple partners is at risk of the disease.

The data from studies in Kinshasa support the conclusion that intercourse is the main route of transmission. In one study of 40 AIDS cases in that city, 75 percent of the victims' spouses were infected, whereas the figure was 12 percent (mainly infants) for other household members.

Several months ago, a French scientist reported that as many as 50 insect species collected in Zaire harboured an AIDS-like virus. However, data on transmission of AIDS, as well as what is understood about the viability of the AIDS virus, indicate that insects are not acting as vectors. "No epidemiologic evidence supports this mode of transmission," says Dr Ronald. "Even the



Photo: Prof. P. Piot

AIDS is often called "slim" disease because of victims' severe weight loss.

French researcher who reported the findings agrees."

The chances for an AIDS cure are grim as the virus is integrated into the victims' chromosomes. A great many drugs react against the virus when tested in the laboratory, but most have been disappointing in real-life tests. An exception to this is azidothymidine (AZT), which was originally developed in 1964 as a possible cancer drug. Recently tested in the United States, AZT appears to prolong the life of AIDS victims. But little is known of the long-term effectiveness of the drug.

The focus, then, must be on prevention of the spread of AIDS through the use of condoms or other measures. A change in sexual habits is another solution, say the doctors from Manitoba. In the next phase of their work, they will be collaborating with the Kenyans to evaluate, among other things, the use of spermicides as prophylaxes. They will also attempt to determine at what point in time the virus is spread from infected mother to child.

A preliminary survey of prostitutes in Nairobi provides some cause for optimism about the potential for control. From a group reporting virtually no use of condoms a few months ago, the current reports are a phenomenal 80 percent usage. Condoms are freely available in Nairobi and elsewhere in the world at family planning clinics. The hope is that they will begin to be widely used and that word about AIDS will move faster than the disease. □

Amy Chouinard is a freelance writer and editor based in Ottawa.

THE QUIET EPIDEMIC

PESTICIDE POISONING IN ASIA



Spraying tomatoes in Malaysia. Developing countries consume only 20 percent of the world's pesticides but account for 99 percent of deaths by pesticide poisoning.

By ANIA WASILEWSKI

In 1974, the World Health Organization used data from 19 countries to estimate that about 500 000 cases of acute pesticide poisoning were occurring annually. Of the resulting 900 or more deaths, a startling 99 percent were in the Third World.

Six years ago in Sri Lanka, a country of 14.5 million people, a study showed that about 13 000 patients were admitted over one year to government hospitals for treatment of acute pesticide poisoning and about 1000 of these died. Although over 70 percent of the cases were suicides, almost 25 percent were occupational or accidental.

Dr Jerry Jeyaratnam, now with the Department of Social Medicine and Public Health at the National University of Singapore, headed the study. "Pesticide poisoning is a problem which hasn't been identified as a health problem in the Third World until recently," he says. "People talk about malaria or infectious diseases, but in Sri Lanka malaria did not cause a single death in 1978, the same year that 1000 people died from pesticide poisoning.

"On the global scene, if the Sri Lankan study were applied, the numbers would be absolutely horrific—2.9 million cases expected annually in the developing world,

resulting in 220 000 deaths."

Many environmentalists around the world see a simple solution: ban pesticides. But for a small farmer in Malaysia's Cameron Highlands the answer is not so simple; without chemical pesticides he could lose up to two-thirds of his crop. As Sinnan Chellapan puts it: "Without pesticides there is no farming."

Sinnan splits his time between driving an ambulance and farming. At the end of a long, dusty road which creeps through the green mountains and surrounding tea plantations, he has a one-hectare farm where he grows cabbage, tomatoes, lettuce, leeks, and celery.

"If I don't apply pesticides for one week the crops are destroyed," says Sinnan. The frequency of spraying depends on the weather. "When it rains, I have to spray every two days. If it's sunny, once a week." In a good year he can have four harvests—he needs three to break even.

Sinnan says he has never had any symptoms of pesticide poisoning, but his blood cholinesterase level is down to 62.5 percent of normal levels, which indicates probable over-exposure to organophosphate or carbamate pesticides. One of the problems with assessing chronic pesticide poisoning is that

the symptoms—headaches, nausea, blurring of vision, muscle cramps, dermatological problems, and eventually lung, kidney, and nerve damage—can also be attributed to other causes. In acute pesticide poisoning, the connection between symptoms and cause is easier to make. The symptoms are numbness, paralysis, respiratory and cardiac failure, flu-like symptoms, burning eyes, and skin lesions, depending upon the type of pesticide and how it entered the body.

Although the developing countries use only 20 percent of the world's pesticides, they account for 99 percent of deaths due to pesticide poisoning. "Pesticide illness is the new Third World disease," according to Dr Jeyaratnam. However, it has not yet been recognized as a high priority by public health officials because of a lack of concrete data on the actual, as opposed to estimated, number of cases.

In 1984, the Asian Association of Occupational Health (AAOH) began to gather detailed information about the extent and cause of pesticide poisoning in small farming communities in Malaysia, Thailand, Sri Lanka, and Indonesia. The study was coordinated by Dr Jeyaratnam and funded by IDRC.

National teams of doctors, health workers, and local people interviewed over 1000 agricultural workers in each country who regularly used pesticides. Hospital records were examined and blood tests given to at least 100 people in each country to check for pesticide poisoning.

In the Cameron Highlands, where 96 percent of the population works in agriculture, people were reluctant to talk about pesticides. They feared that the researchers were from the government and were planning to curtail their use of pesticides. The AAOH research team did discover, however, that in both Malaysia and Sri Lanka over 7 percent of those questioned had suffered episodes of pesticide poisoning in the previous year.

The researchers also found that almost 20 percent of those interviewed in Thailand and 15 percent in Malaysia had suffered from pesticide poisoning sometime in their working life. In Indonesia, repair and maintenance of spraying equipment was the most frequently cited occasion for poisoning, while in Sri Lanka, Malaysia, and Thailand, most of the occupational cases occurred during spraying or mixing.

The study found that, except in Indonesia, pesticide users considered themselves quite aware of the health hazards of chemical pesticides. "But when specific questions were asked on routes of absorption or early symptoms of poisoning it was evident they did not have the required knowledge to behave in a manner which would ensure safe use of pesticides," says the project report.

Most users also said they used "protective clothing and equipment". When questioned closely, however, it was discovered

that their clothing was inadequate and, in the case of Sri Lanka, actually facilitated absorption. "Respirators" were cloth masks such as handkerchiefs or shawls, while "gloves" were polythene bags tied to the hands. Dr Jeyaratnam says there is a "crying need for research" on appropriate protective clothing. "A farmer using pesticides in the Western world uses equipment like a space-man's. That kind of protective clothing can be worn in temperate climates. But if you provide that to the farmer in the tropics you will kill him through heat exhaustion."

Another big problem is equipment failure. Backpack sprayers, the most common method of applying pesticides, often leak. "Farmers know it's harmful but take the risk because it's so expensive to repair and the closest shop is usually hundreds of miles away," adds Dr Jeyaratnam.

The study also found that less than half the workers interviewed in Indonesia had a place to wash themselves after using pesticides or before meals. In Thailand, less than 10 percent had access to washing facilities.

"One of the mistakes we make is to think of the pesticides as the villains," says Dr Jeyaratnam. "It's not a problem with the pesticides themselves, but with improper usage, inadequate education, poor storage facilities, faulty spraying equipment, and lack of protective clothing." The study also pointed out that all four countries have legislation concerning pesticide use, but that it is not adequately implemented.

According to the project leaders, the 7 percent rate of occupational poisoning in Malaysia and Sri Lanka is "unacceptable by any standards". Indeed, among occupational health specialists an accident rate over 1 percent is considered unacceptably high. For Thailand the study recommends the establishment of a pesticide-monitoring agency, the training of agricultural extension workers in proper use and monitoring of pesticides, and the expansion of hospital admission recording systems to better keep track of the problem. The researchers hope that governments are now more aware of the extent of pesticide poisoning in their countries and that they will take action to protect their workers.

In the meantime, Sinnan and other farmers in the Cameron Highlands are caught on what has been called the "pesticide treadmill". Chemical pesticides have helped them increase crop yields and at this point they would not be willing to give them up. Yet, the resistance of pests to pesticides is increasing and environmentalists continue to warn of the ecological and health-related ill effects of widespread use of the chemicals.

Environmentalists now advocate Integrated Pest Management (IPM) which tries to take into account the entire agroecosystem. IPM uses four types of control: biological (introduction of the natural enemies or diseases of target pests), cultural (dates and patterns of planting chosen to minimize

pest damage), genetic (use of resistant varieties) and, if necessary, chemical. This approach is increasingly favoured in North America and Europe as evidence mounts that exposure to some chemical pesticides is linked to cancer in humans and to toxic residues in the food chain and in the environ-

ment. But for Sinnan and the other farmers in South Asia the luxury of choosing such a safer option is not yet a reality. □

Ania Wasilewski is a freelance writer based in Ottawa, Canada.

ON THE TRAIL OF INSECTICIDE RESISTANCE

Three Canadian scientists have discovered that some mosquitoes produce sufficient amounts of a certain enzyme to make them resistant to the commonly used insecticide malathion.

The researchers' work, which combines DNA methods with biochemistry, could make a major contribution to the improvement of pesticide use in future, or even to the artificial transfer of pesticide resistance to beneficial insects.

Since the 1940s, some 400 different species of insects are known to have developed resistance to insecticides. Given the importance of such chemicals in disease control programs and in agriculture, basic research on insect resistance is of major long-term interest to developing and industrialized countries alike, even if applications are not immediate.

Resistance can take the form of altered insect behavior or physical changes in the insect's body. The work of doctors Al Downe, Jerry Wyatt, and Virginia Walker, biologists at Queen's University in Kingston, Ontario, is now shedding light on another resistance mechanism, one of "molecular-genetic" origin.

REMOVES LETHAL PUNCH

The newly characterized enzyme, called carboxylesterase, is produced in larger than normal quantities in malathion-resistant mosquitoes of the *Culex tarsalis* variety (the vector of encephalitis). It enables them to chemically break down the malathion, thereby removing the insecticide's lethal punch.

Malathion is an attractive insecticide because it is toxic enough to control a variety of disease-carrying insects effectively, but has a low toxicity for human beings. Many developing countries use it to control malaria-carrying

Anopheles mosquitoes, as well as *Aedes aegypti* mosquitoes, the vector of dengue and yellow fever. It is also a major weapon in the war against encephalitis in Western Canada.

ENZYME LEVEL 70 TIMES GREATER

In a study of *Culex tarsalis*, the Queen's University researchers discovered that malathion-resistant mosquitoes contain as much as 70 times more carboxylesterase than malathion-sensitive mosquitoes. The biologists' hypothesis is that many copies of the carboxylesterase-controlling gene are present in resistant *Culex tarsalis* mosquitoes, a mechanism known as "gene amplification".

"Once we have completely purified the enzyme we will be able to identify and analyze the controlling gene in the mosquito's DNA," says Dr Walker. "Then and only then can we start thinking seriously about applications of our work." She speculates, however, that it may eventually be possible to artificially protect beneficial insects such as bees which, unfortunately, are sometimes caught in the chemical crossfire of insecticide application. This could be done by injecting the DNA of resistant mosquitoes into the larvae of non-resistant insects, thus transferring the resistance characteristic.

Dr Walker also speculates that hormones may be involved in the gene amplification process. If so, it may one day be possible to apply hormone antagonists with malathion in order to block this process, in effect resistance-proofing the pesticide.

The research team's work has been supported by the Natural Sciences and Engineering Research Council of Canada.

Gerry Toomey

VITAMIN A: THE CHILD'S ALLY



Photo: Helen Keller International

This Ethiopian boy has lost his sight because of vitamin A deficiency. The cornea ruptures in the final stages of the disease, blinding the victim.

By FRANCIS HARAWA

It has long been known that vitamin A deficiency causes xerophthalmia, an eye disease that sometimes blinds its victims. According to the World Health Organization (WHO), xerophthalmia (Greek for "dry eye") threatens 5 to 10 million children in the developing world each year. An estimated 500 000 of them lose their sight.

More recently there has been solid evidence that the lack of vitamin A is also directly linked to two of the developing world's major child-killing diseases: diarrhea and respiratory infections. This evidence comes from a major child health study on the Indonesian island of Sumatra, conducted between 1982 and 1984. The results suggest that distribution of vitamin A to children could end up saving millions of lives each year.

"At first it was believed that this association could be explained by the idea that lack of vitamin A was probably an indicator of the more general malnutrition which is well known to predispose a child to illness," writes James Grant, Executive Director of the UN Children's Fund (UNICEF), in *The State of the World's Children 1986*. "But further analysis has suggested that otherwise well-nourished children who lack vitamin A are more prone to both diarrhoeal and respira-

tory illness than are poorly nourished children who happen to have adequate levels of vitamin A.

"In the one major test of the practical significance of these findings, it appears that distribution of the standard UNICEF vitamin A capsule every six months has succeeded in reducing child death rates (in the age group one to three years) by approximately 30% among a population of over 15,000 children in Indonesia," the report says.

"Should these findings be confirmed, then the maintenance of an adequate level of vitamin A will join the range of low-cost, parent-based ways of protecting the health and lives of poor communities of the world."

It is not exactly known how the deficiency encourages the deadly child diseases. But experts say it might make its victims more susceptible to other diseases by suppressing directly or indirectly the immune system.

Evidence has shown the deficiency also causes the hardening of mucous membranes in gastrointestinal and urinary tracts as well as around the eyes. With these normally wet parts drying and lacerating, a process known as keratinization, they may provide an easy entry for infection.

Results of the Indonesian study, which

was conducted by Dr Alfred Sommer of the John Hopkins University in the United States, have galvanized international efforts to combat vitamin A deficiency. UNICEF and WHO, for example, have distributed millions of vitamin A tablets in affected areas.

Distributing vitamin A capsules to children at six-month intervals appears to be the short-term solution to the problem. But it can be an expensive measure that does not necessarily reach the children at risk.

A second method involves fortifying commonly used foods, in the same way salt is iodized to prevent goitre. Sugar fortified with vitamin A has been tried successfully in Latin America, according to Dr Stephen Moses, an IDRC program officer.

IDRC has been working with the New York-based organization Helen Keller International in Indonesia to investigate the possibility of delivering vitamin A to children through fortification of monosodium glutamate (MSG), a commonly used food additive. Researchers will test the ability of fortified MSG to reduce the early signs of xerophthalmia and to increase vitamin A levels in children and lactating mothers' breast milk.

IDRC is also working on a project in Zambia's Luapula Valley—dubbed the "valley of the blind"—to determine the prevalence, severity and distribution of xerophthalmia and trachoma among children under six years of age. The project will, in addition, identify nutritional and other factors linked to blindness in the Valley.

The long-term solution is nutrition education. "It is in theory a simple solution," says Dr Moses, "but one that is difficult to fulfill because it involves changing people's behaviour." In the meantime, supplementing children's diets with vitamin A will save many lives in Africa, Asia, and Latin America. □

Francis Harawa, formerly editor of the Malawi News, is now a freelance writer in Ottawa.

SIGHT AND DIET

Mild cases of vitamin A deficiency result in night blindness, a condition whereby the victim has difficulty seeing in dim light.

A more severe form of the disease is xerophthalmia. The eyes become rough and wrinkled, and the cornea dries and lacerates, impairing vision. The critical and irreversible stage, keratomalacia, occurs when the cornea ruptures, leaving the victim blind.

Milk, eggs, liver, fish, green leafy vegetables, and fruits such as mangoes and papaya are good sources of vitamin A.

FROM ARABIC TO CHINESE

THE METAMORPHOSIS OF MINISIS

张修智

联合交流等离子弧焊接高强铝合金的新方法

A MINISIS printout: "New methods for presenting automated information."

By ROBERT CHARBONNEAU

The first version of the MINISIS bibliographic information system was developed by IDRC in 1976. This powerful software package, based on the International Labour Office's ISIS software, was designed primarily for computerizing libraries and information centres in developing countries. But more than that, it is able to serve its users in their own language.

MINISIS runs off the Hewlett-Packard 3000 series of minicomputers which are less expensive than main frame computers and thus more easily accessible to institutions in developing countries.

MINISIS became operational in January 1978. Since then, the number of users has increased sharply, with more than 170 systems now on line in 44 countries, most of them in the Third World.

The system's greatest asset is its flexibility. From the start, its designers wanted to develop a system that could easily be adapted to a wide range of languages. The software was initially designed to operate in IDRC's three working languages—English, French, and Spanish—all of which use the Roman alphabet. It was not long, however, before MINISIS was expanded to include Arabic and Chinese characters as well.

ON THE ROAD TO TUNIS

In 1981, the Arab League's Documentation Centre in Tunis was the first institution to propose an Arabic version of MINISIS. The display and printing hardware was already available on the market, but there was still much work to be done to make the system operational.

The development team first had to translate the terminology used by the software to communicate with the user, namely the 6000 or so instructions and messages that can be displayed on the screen. Next, interfaces were installed between the computer and the terminals for data capture and display. These small programs translate the Arabic characters produced by the terminal into memory-stored codes. They also ensure that the codes are in a format that the terminal is sub-

sequently able to display. This provides for information to be uniformly stored, regardless of the kind of terminal used or its particular characteristics. Finally, the team modified the software slightly to adjust for the specific features of non-Roman characters.

All of these modifications made for Arabic were easily adapted to every other language having fewer than 256 characters, including Thai, Korean, Russian, and Greek. These changes have also allowed the system to be adapted to Chinese, a much more complex language.

A person must be familiar with some 2000 characters (or ideograms) just to read a newspaper in Chinese. A Chinese dictionary contains over 50 000 characters. Software manufacturers generally include

One advantage of MINISIS is that it does not favour any one character-coding system.

16 000 of the more common characters in their programs. This represents about 95 percent of what is normally required.

CODING AND CAPTURE

The purpose of coding is to give each character a numerical value. There are several systems for coding Chinese characters. Some institutions, such as the Scientific and Technical Information Centre (STIC) in Beijing, use telegraphy code, for example, which accommodates 10 000 Chinese characters. The advantage of MINISIS is that it does not favour any one coding system.

Capturing Chinese characters, however, remains a real problem. More than 250 different methods now exist. Despite its pro-

motion over the last 20 years or so, the phonetics-based writing system of Pin Yin has yet to gain general acceptance in China.

As with the coding systems, the designers of MINISIS did not wish to favour one method of data capture over another. Terminal users can enter ideograms in any manner they choose, depending on the particular keyboards available and techniques used. The interfaces assure data uniformity.

MORE AND MORE USERS

Because of the flexibility of MINISIS, its future in the People's Republic of China is assured. Already 11 scientific institutions in China, including the prestigious STIC of the Ministry of Machine-Building Industry in Beijing, are now using the software system. The National University of Singapore, which also uses MINISIS, hopes to take advantage of "its linguistic capabilities". The Toronto Metropolitan Library wants to make use of the system's great versatility to manage its multilingual collection.

At STIC there is optimism about the future. All systems are now fully operational and training has been completed. What remains now is the formidable task of computerizing the Centre's library. Some 10 000 titles have already been entered. By next year, STIC will be the fourth largest computerized data base in the country. And this is only the beginning!

Chinese researchers now have a fast and reliable tool for retrieving scientific and technical information produced by their colleagues. The large number of contacts between Chinese scientists and today's global sharing of knowledge demanded such a development. □

For more information about the Chinese version of MINISIS, write to:

Terry Gavin
Information Sciences Division
IDRC
P.O. Box 8500
Ottawa, Ontario
Canada K1G 3H9

WHERE HAVE ALL THE CHILDREN GONE?



Child labour is still an important element in the economy of rural Colombia, generating over 40 percent of family income.

By ELSA RAMIREZ DE ALVAREZ

Pablo is 12. Like all children his age, he ought to be sitting on a school bench listening attentively while the teacher explains the mysteries of the alphabet. But Pablo, the younger son of poor Colombian peasants, has much too busy a schedule to be able to spend all day studying.

At sunrise, Pablo and his brothers and sisters hurriedly swallow a few mouthfuls of food and start earnestly into their chores. First they have to go down to the river to fetch water for the family. On the way back the boys fill their pockets with stones to be used as hunting weapons. Then they put out fishing lines so that the rest of the family will have a few small fish to eat. If they catch any big ones, they will hustle off to the market to earn the cash they need to replace the hooks.

The afternoon has to be spent hunting iguanas and quails with improvised sling-shots. While Pablo plucks the quails, his brother, Juan, ties up the female iguanas to force them to lay eggs. Then they have to

join the rest of the family in their hard labour in the fields—whether it be sowing, weeding, cultivating, harvesting, or storing. In the evening, before they collapse exhausted, they have to take care of their tools.

It is in the rural areas that one encounters the lowest rates of scholastic achievement.

In the middle of this kind of workday, which is enough to exhaust even an adult, little Pablo somehow finds the energy to spend a few hours listening to the lessons given by a teacher from the nearby village. Even if the family depends on Pablo's labour to survive, it still regards his education as essential.

Contrary to popular belief, neither farm work nor remoteness from the school significantly affects school attendance—during the first years of primary school. The change-over more often happens in adolescence when schoolchildren of 12, 13, or 14 enter the work force, dropping out of school to become day labourers. These are the conclusions reached by researchers from Xavierian University in Colombia, after a study of 2400 rural families, conducted with financial assistance from IDRC.

When data collected in interviews with heads of household were examined, it turned out that the rate of school attendance among rural children had increased perceptibly to 78 percent, despite the fact that their parents tended to delay registering them in school.

Although Colombia is categorized as a "developing country", its growth in the last 20 years has been tremendous. Per capita income increased almost 50 percent and a network of schools and health care services has spread to cover the whole country.

However, despite a government campaign to make education available to all children, it seems that those in the countryside are still at a disadvantage. It is in the rural areas that one encounters the lowest rates of scholastic achievement and the highest failure, dropout, and repeat rates.

Although primary school is free and obligatory for children 7 and older, more than half of schoolage children in rural areas are not registered in school.

What is most responsible for this failure—or at least what is usually pointed at as the culprit—is the work the children have to do. Of Colombia's eight million rural people, almost two million are children 7 to 14 years old. Of that number, a little over one million have to work, either for pay in the labour market or to help out with the family's work on the land.

ONE THIRD OF MINIMUM WAGE

Normally at adolescence, a child begins to earn money by working. Child day labourers are usually paid much less than the legal minimum wage, generally about one third, and have to do a hard day's work—8 to 11 hours of continuous and exhausting labour—especially at harvest time.

The data from the survey of heads of household show that 44 percent of family income is generated from child labour. Nearly 17 percent comes directly from work by children under 14.

According to the researchers, a number of factors other than family duties play a role in how much schooling children get. These include the size of the family, the child's rank among brothers and sisters, and the socioeconomic and educational levels of the family.

AVERAGE SCHOOLING IS THREE YEARS

Although primary school is free and obligatory for children 7 and older, more than half of schoolage children in rural areas are not registered in school, the study notes. However, as age rises so does school attendance, reaching a peak of 78.4 percent at around age 11. Attendance begins to decline from the age of 14 on. On average, children spend three years in school, and in the eyes of their parents this is scholastic suc-



Photo: Ronald Duncan

Rural schoolchildren have to split their time between school and family work.

cess. Only 15 percent of those registered in primary school get as far as the fifth grade.

There is a direct connection between family wealth and how long children stay in school. The dropout rate is highest among

In the cities the individual is paramount, whereas in rural communities people are valued as members of a family unit and as potential workers.

the most underprivileged; the children of the well-to-do are least often away from school for any length of time.

The number of children in a family plays only a secondary role. The level of education of the parents, on the other hand, is a much more important determining factor. A child from a small family whose father had only minimal schooling is just as likely to be put to work, either for the family or for an employer, as a child from a large family. But the more education the head of household has had, regardless of the number of children in the family, the more likely it is that the children will go to school. It hardly needs to be said that the most favoured children are those from small families (less than

seven), where the head of the household can read and write and the family is at the middle or upper socioeconomic level.

According to the researchers, one also has to consider some of the cultural values typical of a rural environment. In the cities the individual is paramount, whereas in rural communities people are valued as members of a family unit and as potential workers. Both of these values take precedence over studying. The value of education lies only in its eventual contribution to work.

The data collected during the enquiry are likely to be useful to the Colombian Government in redefining its education policies for the rural environment and bringing them more in line with rural realities.

"Don't forget that under the law all children have to be registered in school when they reach the age of 7, which is exactly the age where their work begins to be really essential to their families," say the authors of the study. "Helping children to reconcile the tasks assigned to them with the requirements of school life is a permanent problem for families. It is a problem that more appropriate government policies might be able to help solve." □

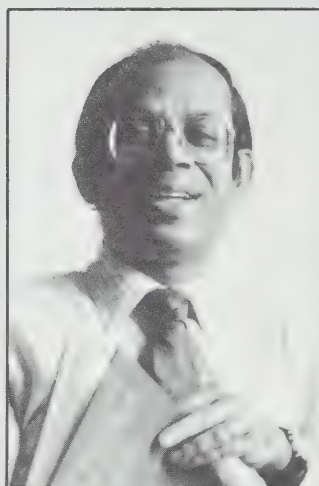
Elsa Ramirez de Alvarez was a member of the Xavierian University research team which carried out the study on the education of rural children. Other team members were Hector Maldonado, Benjamin Alvarez, Orfa Libia Montoya, and Ronald Duncan.

COMMENTARY

BOOKS, KNOWLEDGE AND INFORMATICS

In this modern age of glamorous electronic information systems, books are anything but obsolete, according to Dr S. Gopinathan, co-author of Publishing in the Third World: Knowledge and Development and chairman of the Singapore Book Fair. For many years he was also chairman of the National Book Development Council of Singapore and has served as a consultant on book development to UNESCO, the Commonwealth Secretariat, and the World Bank. Dr Gopinathan was interviewed for Reports by Chin Saik Yoon, regional liaison officer for IDRC's Communications Division, also based in Singapore.

Photo: Chin Saik Yoon / IDRC



Dr S. Gopinathan

Reports: Dr Gopinathan, you recently organized and chaired a seminar here for scholarly and academic publishers from the ASEAN region. Can you describe the overall state of the publishing industry in Southeast Asia and some of the issues that prompted the meeting?

Gopinathan: It has been said that Third World academics are very dependent on the First World. While this might generally be true, we felt a need to examine in detail what has been happening.

First, we knew that in the past 20 years the infrastructure for 'knowledge production' had developed extensively. In effect, there had been an expansion of the higher education system—the major consumer and creator of academic information. Take Malaysia for example. In the late 1960s, it had only one university. By the middle of the '80s, it had six. And the establishment of open universities in countries such as Indonesia and Thailand also added a huge number of students to the information market.

Secondly, we were also aware that modern printing technologies had been adopted in various countries, although sometimes slowly or in uncertain fashion. This

meant that the infrastructure for producing this knowledge on paper was also in place. Admittedly, there is tremendous technological variation in countries such as Indonesia and Singapore. But in contrast to what was available, say, in the '60s, the situation had certainly changed. What we wanted to observe was the impact of such factors—higher education

'The establishment of open universities in countries such as Indonesia and Thailand added a huge number of students to the information market.'

and new printing technology—on the production of scholarly material.

A third factor we were aware of was the shift away from the use of what might be called "metropolitan" languages, such as English in Malaysia, Dutch in Indonesia. In some countries, the use of indigenous languages was on the upswing. What sort of impact was this having on the production of scholarly materials?

We were also conscious of the fact that you could now walk into a specialty bookshop and see a number of titles in a variety of disciplines. We were concerned that many of these scholarly publications were not circulating internationally. So, the problem was not only one of producing books, but of selling them, promoting them, getting them reviewed, alerting the international scholarly community to the existence of these Southeast Asian books.

That explains the background to our seminar. We wanted to explore the changing publishing environment. At the same time, we hoped to learn from the experiences of countries such as Britain and Germany. At the meeting there were a number of resource persons from these countries with marketing experience. What we initiated was a process of interchange and an opportunity for networking.

Reports: Participants at the seminar did not seem overly concerned about the publishing of basic school materials such as textbooks. What is the situation with regard to this area of publishing?

Gopinathan: In many countries the printing of materials for primary and secondary

schools is adequately taken care of. Which is not to say there aren't problems in this area. But by and large, most countries in the region have the necessary writers, the production capacity, and, because of government involvement, the distribution facilities. In Indonesia and the Philippines, the World Bank recently provided major funding to try to improve the availability of books. And over a period of time, UNESCO has addressed many of the issues related to producing school material for the newly literate. So, while textbooks are important, we felt that more attention needed to be paid to academic and scholarly publishing. As the reassertion of intellectual identity and autonomy, such publishing is going to be a very important area.

Reports: In the developing countries literacy rates are often low and there is an urgent need to meet the basics of life—food, water, shelter. Why should publishing be considered important in such a context?

Gopinathan: It is important because it is a means of disseminating knowledge. I don't think you are going to achieve your goal of, say, better health care or more productive agriculture without first finding a way of getting the necessary information across.

Publishing is by no means the only way to communicate the information. But I think a lot of people would accept that basic literacy, however defined, is an important criterion of development. In my view, then, it's not an either/or scenario—either publishing or better health care. I think after 20 years of development experience we've come to recognize that many of these issues and processes are interrelated. So, we're not claiming that publishing somehow stands supreme, but only that publishing is part of the total package.

If you want to raise peo-

ple's consciousness about health and agricultural productivity, then you must realize that publishing is one element in a package of measures you must take.

In many countries, publishing gives the government a certain amount of control over the information disseminated. Newspapers, for example, have tremendous potential as instruments of development, which is one reason why governments are interested. I don't mean this in a negative sense, but countries are seriously attempting to establish their own identities, their own development priorities. Without adequate publishing capacity, they are dependent on the outside world for information. Unfortunately, that information may not be entirely appropriate.

Reports: Do you think the growing use of electronic media such as radio or video in the developing countries will drastically change the role of the print media or replace it?

Gopinathan: I see publishing as being essentially complementary to the other media. Don't forget that the newer technologies have certain disadvantages. You may not always have a power source, for example, to operate your TV set, radio, cassette player, or video machine. On the other hand, as long as people have been taught the alphabet and are able to get printed materials, they can read by the power of the sun, as it were.

So I don't see one set of media replacing another. I think the early predictions about the impact of these new technological means were overly optimistic. Look, for example, at the production of news. You get a half hour on Singapore TV, but you still read the newspapers the next morning. Printed materials are more portable, last for a longer time, and can be shared by more people. There is nothing as portable or as convenient as a

book. Print, I believe, is here to stay. I am very sceptical of prophets who predict the demise of the book.

Reports: The publishing business itself is going through a technological revolution. Expensive electronic typesetting equipment is being introduced, for example. Do you see such things widening the gap between Third World and developed country publishing?

Gopinathan: Yes, I am very worried. I see the repetition of an old trend. In the 1950s we imported a lot of text material because we simply did not have the required

'There is nothing as portable or as convenient as a book. Print, I believe, is here to stay.'

writing, editing, and production capacity. It took us about two decades to build up the indigenous capacity to the point where now most Third World countries can provide their own instructional materials.

It seems to me that the new technologies, not just in printing but in other areas too, need to be examined carefully. Look at the use of computer technology in education, for example, and the promise that it would somehow leap-frog over all the problems of development. I for one see a new technological dependence on the horizon. It is very easy for some countries to dump increasingly inexpensive hardware on us. But the ability to produce software will, I think, be the major technological problem. If you're dependent on someone else's software, then you're dependent to a certain extent on their paradigms and models for learning.

Countries that are wholly enthusiastic about adopting new technologies are going to run into some problems if they move too quickly. What exactly are the consequences of cutting your library budget by half, for example, so you can buy more computer terminals and floppy disks. Given the fact that multinationals have a huge stake in such technology and are doing a lot of promotional work, I think it is important for countries to get together, regionally and internationally, to examine some of the implications.

All this is part of the larger concern over who controls information. We are coming to grips with a major issue, one which I believe is going to trouble us for the next 15 years. Information and data are now viewed as economic goods, in the way metals or labour are. The "information age" is now a reality but we are not yet fully aware of its dangers. I think Third World countries are walking rather blindly into a trap.

Reports: What is happening with regard to the production of books in indigenous languages?

Gopinathan: One of the myths about publishing is that information produced in

'If you're dependent on someone else's software, then you're dependent to a certain extent on their paradigms and models for learning.'

the First World, say, in English or French, can be effectively translated into indigenous languages. Third World countries are still looking to translation as a viable means of acquiring this knowledge. In Malaysia, spe-

cial agencies were set up to translate and produce books, and develop the terminology in these indigenous languages. How successful has the effort been? Does it offer a model for other countries? Interestingly enough, they themselves have found translation to be a 'no go' solution in some cases and they are beginning to invest more time in writing or acquiring original manuscripts for production.

Related to the production of indigenous material is copyright, an issue both national and international in scope. We accept the proposition that intellectual property ought to be protected as much as physical innovations. It is particularly important to do so in countries where book markets are small because of low purchasing power and distribution problems. In such a context no great fortune is to be made from writing, yet it is important that efforts be made to reflect national concerns.

Third World countries import a lot of books. If we had to pay copyright charges, it could mean a loss of scarce foreign exchange. So how does one fulfill the developing countries' need for access to the knowledge contained in these books, while at the same time recognizing the rights of book producers? Publishers are risk-takers, involved in a commercial activity. They have to pay their debts and therefore need the protection of copyright.

In the book I co-authored, we have tried to show that publishing in the developing countries does not stand alone but in relation to publishing in the industrialized countries. We have not tried to present the issues as a confrontation between the two groups. We see this not as a world in which the more favoured and the less favoured will always retain their respective positions, but as an interdependent world moving towards greater equality. □

IN BRIEF



Buffaloes produce 55 percent of India's milk.

Better buffaloes for India

A Central Institute for Research on Buffaloes has been set up in Haryana State in India.

The country has a buffalo population of more than 62 million, about half the world total. However, milk yields per animal are as low as three to four litres a day.

At present buffalo milk constitutes 55 percent of total milk production in India. The main task of the research centre will be to double the per-animal production of milk.

The institute has made arrangements with Pakistan and Australia for the exchange of buffalo semen and nutritional fodder, as well as for the training of personnel. It has also been proposed that regional research centres be set up to improve local breeds.

Source: *Asian Agribusiness*, Vol. 3, No. 4, 1986

IITA wins research award

The International Institute of Tropical Agriculture (IITA) has won the 1986 King Baudouin Award for International Agricultural Research. The award, presented every two years to an international agricultural research centre, recognizes IITA's work on the problem of maize streak virus (MSV).

Maize is an important food crop in much of Africa, but

MSV and other diseases adversely affect its yield. Transmitted by leafhoppers, MSV is endemic to Africa but strikes sporadically.

IITA, in Ibadan, Nigeria, spent 10 years in its efforts to solve the MSV problem. A novel screening technique was developed to identify maize plants with a measure of resistance. These in turn were used as the breeding material from which new resistant varieties were developed for use by African farmers.

Source: *IITA Research Briefs*, September 1986.

Panos Institute

British journalist and environmentalist Jon Tinker has founded a new international information service on environmental and development issues. Created last June, the new Panos Institute now has offices in London, Paris, and Washington.

The Institute intends to initiate projects on a number of topics including: environment and security; environment and illicit drug trading; AIDS in the Third World; the arctic environment; the environmental effects of apartheid; women's perspectives on population policies; and children in cities.

Mr Tinker was formerly head of the UK-based Earthscan information service of the International Institute for Environment and Development (IIED).

Rice husk ash used in water filter

In India, where most of the rural poor do not have access to safe drinking water, researchers are designing a simple water filter made from rice husk ash (RHA).

The Tata Research Development and Design Centre in Pune, supported by IDRC, is testing a number of differently shaped filters, each made from a combination of RHA and various cementing agents. One fits into a clay pot which is used to transport water; another is placed in a bamboo basket which floats on a pond.

"The filter has a great potential because it is extremely flexible and quite cheap," says Alex Redekopp, a program officer in IDRC's Water Supply and Sanitation program. The main expense is the cement. The goal is to come up with a design and formula for an RHA filter that could be easily adapted and made by villagers.

In another project in Tamil Nadu, IDRC-supported researchers are conducting tests with theythancottai seeds to determine whether they too can be used for filtering.

Fungicides combat stress in plants

Fungicides used in agriculture not only control disease but also protect plants from the stresses of heat, cold, and drought, according to two environmental biologists at the University of Guelph in Canada.

Professors Austin Fletcher and Gerry Hofstra have found that fungicides affect the action of metabolically important compounds such as hormones. The triazole group of chemicals, for example, was developed to control economically important diseases such as powdery mildew and rust fungi. But the chemicals also regulate growth and protect plants from environmental stress, the biologists have found.

Fletcher and Hofstra tested fungicide-treated plants for resistance to various stresses. They found the chemicals promote root growth, chlorophyll production, leaf thickness, and overall yield, and also protect against drought, ozone, heat, and exposure to sub-zero temperatures. An important effect was that water loss through the pores of the plant's leaves decreased.

Fletcher plans to field test groundnuts and sorghum for heat and drought resistance during his sabbatical in India next year.

The University of Guelph research is funded by the Natural Sciences and Engineering Research Council, as well as several chemical companies. It involves scientists visiting from India, Ghana, China, and other parts of Canada.

Source: *Research Guelph*, Vol. 2, No. 2, 1986

Major study of changes in the biosphere

A global program to determine the impact of both human activity and natural changes on the habitability of the earth has been announced by the International Council of Scientific Unions (ICSU).

Called The "International Geosphere-Biosphere Program: A Study of Global Change", the research will begin in the 1990s and rely on the most sophisticated land-, sea-, and space-based observations. The program's headquarters will be in Stockholm, Sweden.

The plan was approved in September by ICSU, whose membership includes the scientific academies of 71 countries as well as international scientific organizations in the physical and biological sciences.

One of the most widely discussed global problems is the so-called greenhouse effect. The earth's climate appears to be warming due to the increasing amount of carbon dioxide released into the

air by the burning of fossil fuels.

Other controversial phenomena include acid rain, soil erosion and degradation, desertification, the introduction of new man-made chemicals into the environment, the destruction of forests for agriculture, and the depletion of the atmosphere's ozone layer (which protects the earth from the ill effects of solar ultraviolet radiation). Of particular concern is how all these factors interact.

The plan is to carry out physical, chemical, and biological measurements to identify long-term changes in the global environment as soon as possible. If countries are to prepare for changes, the scientists point out, the changes must be identified well in advance.

Source: *The New York Times*, Sept. 22, 1986

Ecology of wood consumption

Developing countries are usually on the receiving end when blame is assigned for over-exploitation of the world's forests. But according to an article published by ALASEI, a Latin American information agency, the developed countries are the primary consumers of wood, accounting for 88 percent of the world's wood product market.

The Third World has 60 percent of the world's wood supply, but consumes only 12 percent of its production. Yet, it is the Third World that most often suffers the disastrous effects of uncontrolled deforestation, the most important of which are soil erosion, lack of fuelwood for cooking and heating, and the advance of the deserts.

Unless the present rate of desertification is slowed, some 792 million additional hectares of land will be gobbled up by the desert by the year 2000.

Source: *Bulletin of the Agencia latinoamericana de servicios especiales de información (ALASEI)*, no. 60, June 1986.

ILO proposes global plan for urban improvement

The UN International Labour Organization (ILO) has proposed a global investment plan to clean up the slums that encircle many of the developing world's major cities.

In a study entitled "The Case for Low-Income Housing in Developing Countries", author S.V. Sethurama says that the \$116 billion investment needed for the improvements is within the capacity and limited resources of the Third World countries concerned.

The plan calls for the following investments over the next 14 years: \$62 billion in Latin America and the Caribbean; \$11 billion in North Africa, the Middle East, and Europe; \$6 billion in East Africa; \$4 billion in West Africa; \$25 billion in South Asia; and \$5 billion in East Asia and the Pacific.

The scheme poses a formidable challenge to development planners, according to the ILO. But if the poor countries are to solve their urban housing problems, they will have to take bold new measures, even if they involve financial risks.

"What is required," the study says, "is careful husbanding of available resources and their intelligent utilization. Shelters with basic amenities for hundreds of millions of people who live in these slums can be provided if the unemployed and the underemployed among the settlers build their own homes. Tapping their labour would reduce the cost and at the same time contribute to the easing of a major socio-logical problem in the urban centres of the Third World."

ILO economists estimate that the program would generate perhaps 120 million person-years of work, aiding entire regional economies.

Source: Article by Thomas Land, *The Mail-Star / The Chronicle-Herald*, Halifax, Canada, Oct. 9, 1986.

NEW RELEASES



Metodología de Investigación en Sistemas de Cultivo en Finca.

H.G. Zandstra, E.C. Price, J.A. Litsinger, and R.A. Morris. IDRC-215s, 156 pp. Published in Spanish, September 1986.

Originally published in English by the International Rice Research Institute (IRRI), this book details the results of studies done by the Asian Cropping Systems Research Group for the purpose of formulating a cropping systems research methodology. These studies began in 1975 when the group defined its aims and developed its scientific research methods. Since that date, IRRI has given general support to this effort. It has had effective backing from IDRC, which has partially financed the work. The book covers each step in the undertaking and has complementary appendices and a bibliography.

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Reports

THE
IDRC



Hydrologists of the Himalayas



Improved cook-stoves in India

Occasionally *IDRC Reports* has published articles about the effects of desertification and deforestation on fuel-wood supply. One way that international agencies, national governments, and voluntary organizations have attempted to solve the problem of decreasing supplies has been to make woodstoves more energy efficient.

In India's Kerala State, one project with which I am familiar promotes the use of smokeless chulhas (stoves) among the adivasis (tribal people). My observation of this project was only a small part of a larger study of the people's science movement spearheaded by the voluntary organization KSSP (Kerala Science Literature Society).

Since 1982, KSSP has been researching and developing an energy-efficient, low-cost chulha called the Parishad Chulha. India's Department of Science and Technology has provided financial support.

The chulha project involved 100 tribal families in the Kerala village of Amboori, which is in a badly deforested area. KSSP sent in volunteers ahead of time to discuss the advantages of their chulha and to ensure the full participation of the community. Families were chosen on the basis of their receptivity to the idea of trying the stove. Installation and educational work took place in October 1986.

The Parishad Chulha benefits users in a number of ways. First, because combustion and heat transfer are better than with the traditional open-hearth stove, fuel consumption is cut. Home users report 50 percent savings in firewood. Secondly, cooking time is reduced and fewer hours are spent in search of firewood. Thirdly, smoke is eliminated through a pipe above the roof line, making for a healthier kitchen environment. Last, because the Parishad Chulha is made almost entirely of clay, its introduction helps create

employment for local clay-pot artisans and assembly workers. (In recent decades, many Kerala housewives have switched to aluminum pots.)

A typical Parishad Chulha costs 150 rupees (around CA\$20), plus 25 rupees for installation. But the net cost to the homeowner works out to only 104 rupees because the Kerala Government pays a subsidy for installing a fuel-efficient chulha.

In the case of the Amboori families, their only costs were the clay, water, and preparatory labour conducted under the supervision of a trained chulha builder.

My conversations, and those of my assistants, with the families indicated a high degree of satisfaction with KSSP's chulha implementation. Follow-up studies and work are necessary, however, to deal with problems that crop up in any new intervention of this nature.

The Kerala chulha project gave KSSP an opportunity to realize one of its main aims, to bring the benefits of science within the reach of ordinary oppressed and powerless people.

*Prof. Mathew Zachariah
Ulloor, Trivandrum
Kerala, India*

Editor's note:

Prof. Zachariah is currently on sabbatical from the University of Calgary, Canada, where he specializes in international development and education. His work on the people's science movement in Kerala is financially supported by the Social Sciences and Humanities Research Council of Canada and the Shastri Indo-Canadian Institute. For more reading on Indian chulhas, see page 10 of the January 1987 issue of Reports.

The probability of success

While working as an agricultural economist in Rwanda, I was struck by the relevance for the development effort of calculating the odds of success of a project. If planners would stop to make some crude assumptions and basic calculations of the probability of success, many projects that are practically doomed to failure would not be started—and scarce develop-

mental resources would be saved for more promising projects.

We in the development field have a "can do" attitude about our work. When one approach to solving a problem doesn't work, we use another. It is frustrating, then, for officials engaged in economic development to see the number of times that projects fail. Project evaluations often identify specific implementation problems. However, there is a fundamental statistical principle that explains why so many projects and activities fail.

The principle is this: if you have a series of activities all of which have to be accomplished to achieve the goal, the probability of success of the project is found by multiplying together the probabilities of success of all the activities.

In the world of development projects, a number of tasks must be undertaken to complete a project. In a typical example, the technical assistance team must be of high quality, the government must supply qualified counterparts, the government must pass essential legislation, and an effective local self-help organization must be formed. Suppose that for each of these four required actions there is a 60 percent chance that the basic condition will be met. Under these assumptions, what is the chance of success of this project? We need to multiply the four probabilities: $0.6 \times 0.6 \times 0.6 \times 0.6 = .13$ or 13 percent.

For a project with tremendous potential returns, a 13 percent chance of success conceivably could be satisfactory. But for most projects, such a low level of probability would imply that the project as originally designed should not be undertaken.

The lessons for the project designer are clear. When planning a project, we should identify those conditions that are essential to the project's success. We should then make a guesstimate of the probability for success of each condition and multiply them. We will then have a rough and ready estimate of

the probability of the project achieving its objectives. By acting on such calculations, we can avoid the embarrassment of explaining after the fact why the project didn't work. If the odds of success are too limited in light of the potential benefits of the project, then it's back to the drawing board.

*John T. Craig
Economic Consultant
Washington D.C., USA*

Information on diseases

In the October 1986 issue you describe the IDRC's Development Data Bases Service. I write to let you know that the information collected and published since 1984 by the Bureau of Hygiene and Tropical Diseases on tropical and communicable diseases is available (for a fee) for on-line searching through CAB International in Slough, England. This service gives access to our two abstract journals—*Abstracts on Hygiene and Communicable Diseases*, and *Tropical Diseases Bulletin*.

We also have a data base specifically on AIDS, which contains annotations as well as abstracts. This is a more comprehensive service than the selective and critical service we supply on public health, as it contains indicative annotations of all the papers we scan. This will be available in North America on BRS (including its Colleague service) and is already accessible through Data-Star.

Our Bureau would welcome suggestions as to how we could support the free dissemination of this information to developing countries.

*D.W. FitzSimons
Bureau of Hygiene
and Tropical Diseases
London, U.K.*

Editor's note:

The Health Information program of IDRC's Information Sciences Division provides financial and technical support to help Third World countries to build their own health information systems and services. These are of immense use to researchers, technologists, and policymakers. Numerous projects—for example, the Philippines' Health Research and Development Information Network—are now in progress.

Reports

THE IDRC

Cover photo: A young Pakistani porter takes a short break on his way up to the glacier. (See article on page 6.)



Photo: Kenneth Hewitt

IDRC

The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in five sectors: agriculture, food, and nutrition sciences; health sciences; information sciences; social sciences; and communications. IDRC is financed solely by the Parliament of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are located at 250 Albert Street, Ottawa, Canada (P.O. Box 8500, Ottawa, Canada K1G 3H9). Regional offices are located in East Africa (P.O. Box 62084, Nairobi, Kenya); West Africa (B.P. 11007, C.D. Annexe, Dakar, Sénégal); Asia (Tanglin P.O. Box 101, Singapore 9124, Republic of Singapore); South Asia (11 Jorbagh, New Delhi 110003, India); Latin America (Apartado Aéreo 53016, Bogotá D.E., Colombia); and the Middle East (P.O. Box 14, Orman, Giza, Cairo, Egypt).

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The IDRC Reports and its companion editions in French and Spanish — *Le CRDI Explore* and *El CIID Informa* — are published quarterly by the International Development Research Centre. Their aim is to keep readers informed of the activities of IDRC and to present articles on subjects related to the Centre's fields of interest. An Arabic version *بحوث للتنمية* is published annually. Copies are available on request from the Communications Division, IDRC. *Editor-in-Chief:* Jean-Marc Fleury. *Associate Editors:* Gerry Toomey (English edition), Robert Charbonneau (French edition). *Spanish edition:* Stella de Feferbaum.

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Unsolicited manuscripts and other editorial materials are welcomed and will be considered for publication.

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CONTENTS

Letters	2
Unravelling the patchwork	4
Computer tools make life a lot easier for Brazil's transport planners. <i>By Douglas Janoff.</i>	
Ice men of the Himalayas	6
On top of the world, Canadians and Pakistanis team up to study melting snow and glaciers. <i>A report by the chief hydrologist, Dr Kenneth Hewitt.</i>	
Light at the end of the tunnel	8
In Cairo, engineers finetune subway-building methods by predicting soil behaviour. <i>Robert Charbonneau explains.</i>	
The land is on fire	9
Satellite images help researchers to evaluate Senegal's peat reserves. <i>By Manon Cornellier.</i>	
For the sake of the seas	10
Canadian and Chinese scientists study pollution off Vancouver Island. In fact, they've got it in the bag. <i>By Julie Henderson.</i>	
Predicting famine	11
Human behaviour patterns suggest a way to foretell famine before it's too late. <i>By Gerry Toomey.</i>	
Saleable seeds	12
Growing vegetable seed may be an attractive alternative for Thai opium farmers. <i>By Mark Timm.</i>	
Covering all angles	14
An integrated development project in Thailand. <i>Photos by Neill McKee, text by Dr Carol Vlassoff.</i>	
In search of lost fertility	16
Many soils contain plenty of phosphorus, but not in a form available to plants. <i>By Fawzy Kishk and Robert Charbonneau.</i>	
Mangroves and fish	18
As an integral part of the ecosystem, Malaysia's coastal forests nourish nearby marine life. <i>By Liza Linklater.</i>	
Gently, please	19
Thai researchers have redesigned a village rice mill so that fewer grains get broken. <i>By Gerry Toomey.</i>	
Paying the price of prostitution	20
Thailand is trying to stop the spread of gonorrhea which now infects 6 percent of the population. <i>Denis Marchand reports.</i>	
Africa's charcoal dilemma	22
Despite deforestation, demand for this cheap fuel is growing in Africa. <i>By Paul-André Rochon.</i>	
Commentary: Different countries, different needs.	24
IDRC states its position on the issue of plant breeders' rights.	
Briefs	26
News and trends in international development.	
New releases	27



UNRAVELLING THE PATCHWORK

TRANSPORT STRATEGIES FOR BRAZIL

By DOUGLAS JANOFF

Imagine a country larger than continental USA but without an integrated railway system. Brazil, now with a population of about 140 million, relies on trucks to transport 70 percent of its domestic freight.

Eight years ago, Brazilian and Canadian transport experts put their heads together and asked some hard questions about the complex nature of Brazil's internal transport system. Now, as the computer modelling system they developed begins to be applied, their efforts are beginning to bear fruit.

NORTHERN PARTNERS

Since 1981 IDRC has offered developing country scientists the opportunity to work side by side with their Canadian counterparts.

During the 1986-87 fiscal year, the Cooperative Programs accounted for CA\$16.4 million of IDRC's total Parliamentary grant of \$101 million. Half of these funds earmarked for cooperative projects are administered by IDRC's regular program divisions, the other half by the Cooperative Programs Division.

During its six years of operation, the division has launched a number of research projects in the earth sciences. A few of these are described in the following pages. More recently, it began funding a series of research projects aimed at fulfilling the needs of small and medium-sized enterprises. This new program is rapidly taking shape.

Finally, the division has begun financing projects under a new research program on construction technology and materials.

IDRC's Cooperative Programs were born of the 1979 Vienna conference on science and technology for development. At that meeting the developing countries expressed a clear desire to tap the scientific knowledge and expertise built up by the industrialized nations.

The developing countries meant what they said. In the case of IDRC, they have responded with great enthusiasm to the idea of close collaboration with their Northern colleagues. In fact, four out five cooperative funding requests that IDRC receives come from the developing countries.

In keeping with IDRC's overall philosophy, the Cooperative Programs will continue to give priority to proposals from researchers in the Third World.

Since 1979 the Transportation Research Centre (CRT) at the University of Montreal has enjoyed a close relationship with the Science and Technology Centre at the Catholic University (PUC) of Rio de Janeiro. Funding from the Canadian International Development Agency helped to establish these links.

In addition to many exchange visits of professors and graduate students between the two universities, their main concern for the past three years has been an intensive applied research project financed by IDRC. Through this effort, Canada's most up-to-date technology and analytical methods are being shared by Brazil's top experts in the transport field.

The original project goal was to study all freight transport in Brazil and to design a model that would assist in transport planning and help the country to achieve greater efficiency at lower energy costs. "I knew it would be a big job, but I never imagined it would be so difficult," said José Leal, an associate researcher and professor of industrial engineering at PUC. Mr Leal has studied transport systems in Chile and Germany and has visited the University of Montreal several times to collaborate with CRT researchers.

Indeed, the scope of the IDRC project was so vast when first proposed in 1982 that researchers soon realized it would have to be cut down to cover one area of the country. "We decided we would be most effective if we concentrated on the southeast," explained Walter Porto Junior, the project's principal researcher in Brazil. "Then we could use it as a model to be applied and adapted to other regions."

It was also felt that the project needed the support of Brazil's Transportation Planning Corporation (GEIPOT). Contacts were made and GEIPOT became a full partner in the current implementation phase of the project.

The main difficulty in studying domestic cargo transport in Brazil stems from the fact that the railroads built in the last century were laid by individual companies to bring one particular commodity to market. As raw materials became depleted or market conditions changed, railroads fell out of use. The government thus ended up with a patchwork of railways with different track gauges, varying from 1 to 1.6 m in width.

Because of this historical lack of integration of the railways, Brazilians are now heavily dependent on ground transport to move goods throughout their immense country. Unfortunately, ground transport is not usually



Photo: Teodor Crainic

as fuel efficient as coastal shipping or rail transport.

Brazil has made some inroads in cutting dependence on petroleum by converting to "gasahol" for lighter vehicles, but larger vehicles still require diesel fuel. Given that the country has the world's second largest foreign debt and is an oil-importing nation, the pressing need for alternative, energy-efficient transport strategies is obvious.

On the campus of the palm-fringed university, professors and graduate students gather in the midday heat to discuss the problems and successes of the past three years. They all agree that the biggest problem was gathering data—a feat that took two years to accomplish. First they had to make contacts in order to find sympathetic sources within each railway company.

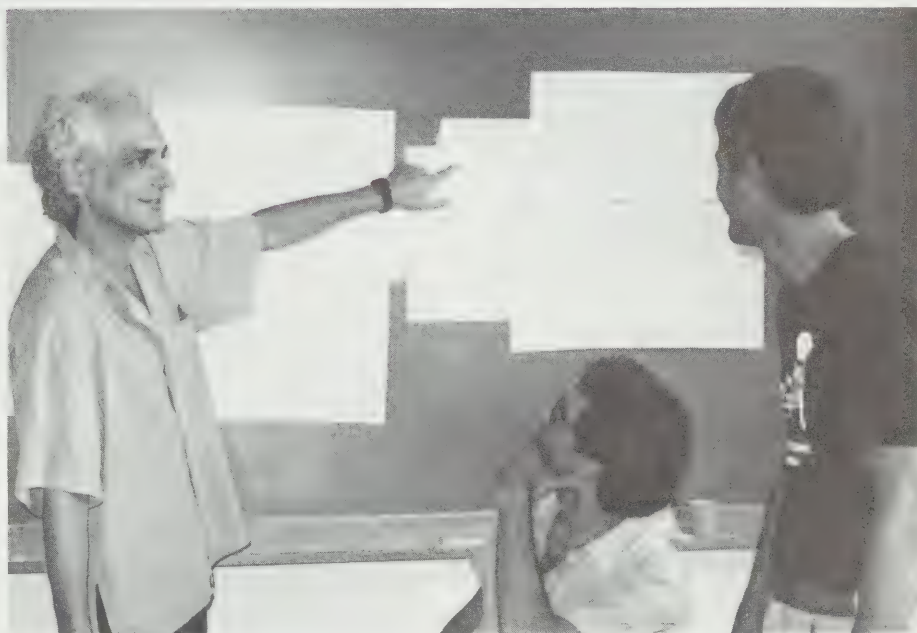
"There was a lot of resistance to giving us their actual costs instead of the tariffs they charged the customer," says Mr Leal. He explains that the only way they could collect the data was to travel to each office in the region, meet people, explain what the university was doing, and try to convince the companies that they would eventually benefit from a more integrated transportation system.

Mr Porto points out that classifying the information also became a major headache. "We had so many incompatible sources of information," he says. "First there were the companies, then the government transport agency, the import/export authorities—and every office had a different way of classifying it!"

But the main result of the project—a computerized system for analyzing transportation options at the national and regional levels—is now ready (see box). GEIPOT has begun using it to generate scenarios for specific parts of the country's freight network.

There is an added benefit to the work of the Brazilians in that they have gained expertise in a number of technical areas such as computer graphics, mathematical modelling, and operations research. That know-how will no doubt eventually make a contribution to Brazil's progress in fields other than transportation planning. □

Douglas Janoff is a Canadian journalist currently on leave of absence from the Montreal Gazette daily newspaper. He has received a Young Canadian Researchers Award from IDRC to examine Canada's contribution to Brazilian socioeconomic development. He is based in Rio de Janeiro.



Project Coordinator Walter Porto with José Leal, professor of industrial engineering, and student Henrique Torres.

ANALYSIS BY STAN

"With not much money they have to do a lot," says Dr Teodor Crainic, a professor of operations research at the University of Montreal's Transportation Research Centre (CRT). "That's why a planning tool is needed."

The task to which he refers belongs to Brazil's transportation planners: to improve the efficiency and cost-effectiveness of moving goods within the country. And the name of the planning tool he alludes to is STAN, a rather disarming anthropomorphic acronym that stands for Strategic Transportation Analysis.

"The new government in Brazil wants to improve internal transportation," says Dr Crainic. "Export corridors are especially important" because Brazil depends on its exports to finance its huge foreign debt.

Developed by CRT, STAN is essentially a package of computerized analytical tools designed to tackle a variety of transport problems. Data analysis and modelling work were carried out by researchers at the Catholic University of Rio de Janeiro, in collaboration with Brazil's Transportation Planning Corporation (GEIPOT). This has made it possible to use STAN to solve problems specifically related to Brazil's domestic freight traffic and export corridors.

STAN, which makes use of interactive computer graphics, helps to generate various transport scenarios and determines the impact each scenario would have on the rest of the transportation system.

For example, government planners might wish to know the advantages of having two rail companies collaborate on moving Brazilian hinterland grain to port for export. They could then compare that scenario with one in which they give exclusive rights to one company or the other. Or, planners may wish to find out how much faster freight would move between two areas of the country if money were invested to build a new bridge or to install an improved railway signalling system. These are the kinds of problems STAN can help solve.

The package includes various tools that help the planner to deal with an array of intertwined variables—freight volume, costs of equipment and fuel, distances, speed of traffic, and so on—that otherwise might defy quick and accurate analysis. □

Gerry Toomey

ICE MEN OF THE HIMALAYAS

PROBING THE SOURCE OF THE INDUS

Pakistan and its economy depend on the waters of the River Indus, most of which derive from snow and glacier melting in the Himalayas. In Canada, the study of snowcover, glaciers, and their melting is well developed. Geographer and glacial hydrologist Dr Kenneth Hewitt describes a cooperative Pakistani-Canadian project that aims to improve forecasting and management of large-scale irrigation and power systems based on Indus waters.

By KENNETH HEWITT

In the summer of 1986, Canadian scientists and Pakistani engineers returned to the Himalayan and Karakoram Ranges for a long field season investigating glaciers and snowcover. Some of us remained as long as four months at high altitudes. Tonnes of supplies were trucked to the heads of jeep roads in the mountains. From there, everything had to be carried to high camps by porters. Access for some teams required many days of difficult travel on foot, sometimes on skis.

Only then could the research begin. This involved measuring a range of conditions that determine snowcover, the behaviour of glaciers, and yields of meltwater from snow and ice. Such work can only proceed safely and effectively with skills and equipment more commonly associated with mountaineering. Training our Pakistani colleagues in these techniques is an essential part of our task.

About 125 million people live within the Indus Basin, most of them in the dry, subtropical plains of Pakistan. They depend upon the Indus streams to irrigate their fields, to produce electric power, and to supply domestic and industrial water to the cities.

It has long been known that only in the northern mountains, above an altitude of 2800 metres or so, does Pakistan have an annual surplus of moisture. Everywhere else, climates are arid or semi-arid with moisture deficits. Monsoon rains are important for a few weeks of summer, but even then the main Indus and its western tributaries, whose waters are available to Pakistan, are mainly fed by snow and glaciers. A poor water yield from the melting snow and glaciers can actually cause drought elsewhere.

As late as 1960, however, most of the waters of the Indus flowed untapped into the Indian Ocean. Since then, mainly under the direction of Pakistan's Water and Power Development Authority (WAPDA), huge

projects have been completed that harness most of these river waters. In some months, nearly every drop serves irrigation, power, and other functions. Thus, rather suddenly, the nature and variability of stream flow from the mountains has become an urgent concern. Reservoir operation, flood control, and water conservation measures cannot be carried out efficiently unless those in charge understand—and are able to forecast—events amid the high snows and glaciers.

Unfortunately, knowledge of these mountainous headwaters, especially snow and glacier conditions, is insufficient. In the areas where most of the water originates, above 3000 metres or so, there are no permanent observing stations. Often there are no accurate maps or other aids.

At the request of WAPDA, a three-year project, jointly funded by it and IDRC, has been organized for research and training in snow and ice hydrology. Research is essential to lay the foundations of a monitoring and forecasting system for the mountain headwaters of the Indus. Training will enable WAPDA to implement and manage such a system in the future.

The cooperative effort is called the Snow and Ice Hydrology Project, and draws on expertise in Canadian universities. The research team comprises 18 Canadians and nine Pakistanis. The Canadian input is coordinated from Wilfrid Laurier University, in Waterloo, Ontario; the Pakistani activities are coordinated by the Hydrology Investigations Division of WAPDA.

Direct investigation of snowcover and glaciers is by no means the totality of our activity, nor an end in itself. It is, however, an essential foundation for all project goals in that it provides the research team with both hard data and field experience.

The main need is for investigations at elevations between 3000 and 7000 metres. It is there that one sees most of the 'hydrological action'—the conditions and processes that determine water yield to the rivers.

Snow and ice conditions vary across the Upper Indus Basin. That is not surprising given that its total area exceeds 260 000 square kilometres. Rivers draining the southern half, or main Himalayan and Front





Photo. Kenneth Hewitt

Ranges, are almost totally snow-fed. Those of the northern arc, draining the Karakoram and Hindu Kush Ranges, are largely glacier-fed. The heavily glacierized Nanga Parbat Range is an important exception in the south.

Weather is closely linked to melting and other aspects of the mountain environment. Last summer there was a striking illustration of this. Major monsoonal storms—a relatively rare occurrence in the mountains—dumped rain at lower altitudes and increased snowfall at higher altitudes. Contrary to expectations, this resulted not in an increase in water yield but a decrease. River flow declined to between one-third and one-half of its pre-monsoon level. In effect, the increased cloudiness caused by the monsoons reduced

Snowfall is also of major interest. Since most of it occurs in winter, we must begin our field season early to measure the snow cover before the main melt begins.

The glacier situation is rather different. In the perennially frozen areas there are, in effect, permanent natural records of past snowfall. The number of years for which we can obtain a snowfall record is limited only by how deep we are willing to dig our snow pits or drill down with a snow corer. By analyzing the chemistry of the snow back in the laboratory, we can also determine the time of year it fell, the areas the moisture came from, and the quality of the water.

Snow and ice melt must be carefully monitored. For this we use networks of stakes on

Although thinly populated compared to the lowlands, the mountains contain several large towns such as Gilgit, our headquarters, and thousands of small villages. These depend on snow and ice melt for agriculture and watering of mountain pastures. The men are accustomed to spending months at the high pastures and many have been porters on climbing expeditions at higher altitudes. As porters and guides they have been essential to the research team's work.

Surface conditions in these high mountains are dynamic. Steep slopes, a great range of altitudes, strong climatic variations, and frequent earthquakes promote vigorous natural occurrences. Many become serious hazards to economic development. Notable in the Upper Indus Basin are avalanches, mudflows, landslides, glacier dams, outburst floods, and glacier 'surges'. These threaten mountain installations, access routes, and the progress of work such as ours.

From time to time, the development and bursting of glacial lakes has caused devastation hundreds of kilometres downstream. Such floods are a threat to new water and power installations and to river communities. Our work includes a review of the problem with a view to recommending monitoring and forecasting methods.

The Snow and Ice Hydrology Project focuses on Pakistan's water systems. Yet it relates to a global trend: the search for ways to tap natural resources in increasingly remote or difficult environments. Canada, for example, is active in the high Arctic and on the continental shelves. And numerous tropical and subtropical countries are looking to hitherto little used high mountain areas to aid development, especially the supply of water to dry lowlands or plateau areas. We anticipate a growing need for expertise in hydro-science and the logistical problems of such enterprises. □

Dr Kenneth Hewitt, a Canadian, is Principal Investigator for the Snow and Ice Hydrology Project and has been Professor of Geography at Wilfrid Laurier University in Waterloo, Ontario, since 1976. He has conducted environmental and hazards research in the Canadian Rockies, the Eastern Mediterranean, and South Asia.



Photo. Kenneth Hewitt

The Pakistani-Canadian team pauses during its ascent.

the amount of sunshine and hence the rate of snow and ice melt. The increased reflectivity of the fresh snow cover at higher altitudes had a similar effect.

Precipitation, humidity, temperature, and solar radiation are the most useful indicators in forecasting water flow. They vary markedly with altitude, across the basin, and over the water year. Hence, measurement of atmospheric conditions in each of four basins under study is one of our main activities. Some of this data collection is carried out with automatic recording systems developed in Canada to meet our special needs.

the glaciers and a variety of surveying methods to record rates and patterns of change in snow or ice surfaces and to correlate these with the weather and other conditions.

The Canadians are responsible for setting up and directing the research and carrying out some of the more specialized and very high altitude work. But essential observing programs, such as those related to weather and river discharge, have been largely carried out by WAPDA officers, two of whom have come to Canada for graduate training, with the aid of IDRC fellowships.



LIGHT AT THE END OF THE TUNNEL

SOIL AND THE CAIRO SUBWAY

By ROBERT CHARBONNEAU

The construction of Cairo's subway system is a unique event in the history of this gigantic city, now the largest in Africa with its population of 12 million.

The subway has been talked about since the 1950s but it still isn't completed. Standing in the way of the achievement of this dream have been a number of administrative and technical stumbling blocks.

First, the six companies responsible for the city's services (gas, electricity, water, and so on) all had to sit down together to discuss the project. A committee was set up to coordinate the work of the companies.

The new subway system under construction consists of three electrified lines. Two of them, 10 and 14 kilometres long, are urban lines that cross the city core. One line runs above ground in the northern and southern suburbs and then goes underground for 4.5 kilometres to cross the downtown area.

The composition of the soil has put constraints on tunnel construction. Most of the soil is extremely unstable sand, clay, and alluvium. This made it preferable to use "cut-and-cover" techniques in which a trough is excavated, the sides are faced with walls, and then the bottom and roof are poured in concrete before reconstruction of the streets above.

This normally simple technique, widely used in subway building, is complicated by two problems peculiar to Cairo.

The first difficulty is water seepage. The Nile River runs through the heart of Cairo and its water can easily seep into the sandy soil of its banks. In some sections of the work site the water table is only 50 centimetres below the surface. This greatly complicates the work. The volume of the seepage is so great and the flooding so fast that it is out of the question to try to solve the problem by continuous pumping. And because it doesn't rain often in Cairo, the drainage system wasn't designed to cope with a heavy flow. Lastly, environmental protection laws prohibit the routing of pumped flood water back into the Nile.

The other major difficulty is traffic. Every day there is an influx of thousands of vehicles into the streets of Cairo, creating numerous traffic jams. Even the slightest blocking

off of streets for road work creates a chain reaction of confusion. Road crews are under orders to minimize their effects on the traffic which already moves at a snail's pace because of the density of vehicles. Tahrir Station, the main transfer point in the transit system, is built beneath an enormous square. In order not to worsen the congestion in this important nerve centre, the builders broke down the construction of the station into 14 phases. A little later, building the line across a city boulevard required 12 phases.

Work on the subway system began in 1982 when service lines were diverted. The excavation work is now almost finished. It is hoped that the first suburban line, 42 kilometres long, will be inaugurated in July 1988. This north-south line is expected to handle 60 000 passengers an hour in each direction.

The National Authority for Tunnels, which is in charge of the project, is proud of its on-site research. A team of Egyptian technicians, for example, is busy taking measurements in a section of tunnel and at one of the five stations in order to evaluate the behaviour of the soil at various stages of the work. Researchers at Ain Shams University, including Mr Fathalla El-Nahhas, wanted to learn techniques hitherto unknown in Egypt, and the construction of the subway gave them an opportunity.

The Cairo subway runs beneath avenues with extensive service conduits and brushes by buildings which rest on relatively unstable soil. At any large construction site like this, the behaviour of the soil has to be constantly monitored. There are various parameters to be observed such as "creep" subsidence, flexing, and water seepage and pressure.

The Ain Shams researchers installed measuring devices and gathered extensive data of this kind during the construction of the first line. The measurements were stored in a microcomputer and processed to produce a mathematical model for predicting soil behaviour under Cairo conditions.

The model can now be used to predict soil behaviour on future subway construction sites. The Egyptians received support from IDRC to help with this technology transfer. Specialists from the University of Alberta, among them Mr Zdenek Eisenstein, had al-

ready designed computer programs of this kind. The Egyptian researchers collected soil movement data on site at various stages of the work and visited their Canadian colleagues to be brought up to date on the most recent techniques for modeling soil behaviour.

By helping to finetune construction methods, the computer model should be of considerable help to the builders in keeping costs down and meeting deadlines. The excavation firms can also provide a safer work site for their employees and avoid undermin-



Photo: Robert Charbonneau

ing the foundations of downtown Cairo's splendid buildings.

Measurements of soil movement were taken regularly along the excavations twice a day in some of the more critical locations and every week or month in places less sensitive to soil movements.

Hanna MacKary, the project manager who works for the National Authority for Tunnels, is proud of his worksite. In the midst of a traffic jam at Tahrir Square, close to the largest movable concrete factory in Egypt, he watches over the progress of the fourteenth phase in the construction of the new subway station. He knows that the computer model developed by the Egyptian and Canadian researchers will be put to good use when the next sections are built. It will help to save hundreds of hours of work, render unnecessary a variety of precautions, and eliminate the risk of damage to nearby buildings. □

THE LAND IS ON FIRE

A major challenge facing the countries of the African Sahel is to find alternatives to firewood as they try to halt deforestation and desertification. And they must do this without adding to their debt. One promising possibility for Senegal is to put local peat resources to work.

By MANON CORNELIER



Collecting soil samples on potential peat sites.

Towards the end of 1980, villagers in the Niayes region of northwestern Senegal noticed that the land literally caught fire whenever they lit a fire to cook. They reported the phenomenon to the authorities.

At first it was thought that natural gas might be responsible and the Ministry of Industrial Development sent in technicians who were surprised to discover that the cause of these spontaneous fires was peat.

An initial survey was done in collaboration with the French Bureau of Geological and Mining Research. It estimated the potential of the Niayes region at 40 million cubic metres of good-quality energy-producing peat that could be burnt directly. The Senegal Peat Company (CST) was set up and more thorough studies were undertaken with the assistance of other countries.

But how can the potential of Senegal's peat reserves be quickly evaluated?

IDRC's first cooperative research project with the private sector was set up with the Montreal-based Cartier/Monenco engineering firm to find the answer to that question. Its task is clear: to test the feasibility of using remote sensing (for example, aerial photography combined with computerized data analysis) to identify new peat areas, evaluate their quality, and define possible applications of the resource.

"This is a pilot project," explains Paul Courteau, Cartier/Monenco's coordinator and project director. "The main research element is to determine the applicability of remote sensing as a way to locate zones containing usable peat in a region of Senegal.

"The peat is covered with sand and clay. We had to find a quick and inexpensive way to assess its potential. Satellite photography seemed like the most suitable method, but since it is usually only used for surface research, it had to be adapted. Without this,

we would have had to do a land-based survey of the entire country which would have taken 20 years!"

It has taken three months of hard work in constant collaboration with the Senegalese researchers. The existing software for surface studies had to be modified, a whole tonne of samples had to be analyzed to establish the various types of soil composition, and the types had to be matched with satellite photos and analyzed by computer to produce an initial set of maps. Next, the research team had to go back over the terrain and refine their analyses to make up a new set of maps. That time around they had it right. Independent verification in Senegal confirmed the results. In areas where the computer indicated there was no peat, the results were 100 percent correct. In places where their results indicated there should be peat, they were 87 percent correct.

"Except for the Niayes deposits, which we didn't work on, no massive deposit was found," says Mr Courteau. "But it does seem that there are quite enough separate areas to justify working them. We still have to find out how deep they are and if the quality is good. Up to this point—and given our level of funding—we haven't yet been able to evaluate either the quantity of peat available or underwater resources."

Can the peat so far discovered be used? "As it is, no," says Mr Courteau. "It is too salt-contaminated and will have to be treated." Without that, he says, it would take only a month for the bottom of a cooking vessel to fall out because of salt corrosion.

Given this situation, Cartier/Monenco went into action with the Ontario Research Foundation. They managed to purify and desalinate that portion of their peat samples that consisted of large lumps. To make the remaining 55 percent usable—it consists of dust—further research is needed.

For the usable portion, they have found

a purely mechanical method of cleaning and purification. The peat burns well and the tests are conclusive. "We chose a process which doesn't involve carbonization. It's a lot cheaper," says Mr Courteau.

"The usable 45 percent seems to be enough to justify exploitation. Despite the current market price, charcoal is more expensive. The Senegalese Government subsidizes charcoal and the price does not include the cost of reforestation. Cutting wood for charcoal also poses the threat of desertification, and this is a country where the desert is visibly expanding. Peat, as an option, is most attractive."

Whether the peat is worth exploiting and how to use it are issues still to be settled. As Cartier/Monenco sees it, the results obtained make it worthwhile to proceed to studies of how much there is.

To reach that point a lot of work remains to be done. A few examples . . . There are still promising peat sites to be identified. The quality of the peat needs to be evaluated. A thorough technical and economic study is needed to identify different ways of using it. Further research is required to see whether the purification method already developed can be used for peat dust. And an effort must be made to identify possible non-household applications of peat.

"We think it is unlikely that industrial use can be made of it," says Mr Courteau. "Another question is whether the amount available can meet 100 percent of domestic needs."

Ecologically speaking, the domestic use of peat in Senegal is extremely important. This is a country where to stop the cutting of firewood—and therefore to halt spread of the desert—has become a top priority, a life and death issue. □

Manon Cornellier is a freelance journalist based in Ottawa.

FOR THE SAKE OF THE SEAS

OCEANOGRAPHY AND CANADA'S
LINK WITH CHINA

By JULIE HENDERSON

Raincape whipping in the wind, Jinping cycles stoically across the rain-soaked peninsula. He is heading towards the research institute where he is working and studying oceanography. As he arrives, he looks across the water at three white hoops of steel bobbing symmetrically on the surface of Saanich Inlet. They are part of an experiment in marine ecology.

Almost 10 000 km away from home, Jinping Wu, a scholar from Xiamen, China, is following a training program that will allow him to help his country to improve its understanding of marine pollution. He feels fortunate to be one of a team chosen to participate in the summer "bag" experiments at the Canadian Department of Fisheries and Oceans' Institute of Ocean Sciences on Vancouver Island off Canada's Pacific coast.

Ten years ago, reading an article about "marine enclosed ecosystem experiments", or MEEEs, in an American journal, he envisioned a day when China would have similar technology. Jinping regards MEEEs to be "one of the most promising experimental techniques in marine chemistry and ecology research". Today, with support from IDRC, his vision has become a reality.

Each summer, from 1983 to 1986, Chinese scholars joined Canadian scientists at the Institute in a research program designed to strengthen marine pollution research and to enhance cooperation between the two countries.

Part of the program has also been conducted in China. In the spring of 1984, a team of marine scientists from the Institute and from the Department of Oceanography of the University of British Columbia (the third partner in the program) arrived at the Third Institute of Oceanography in Xiamen. They

unloaded crates of equipment and instruments and began their work. Within two years Jinping stood on the shores of Xiamen Bay and looked across the water at China's own 'bag site'.

A marine enclosure, as described by oceanographer Frank Whitney, is "a polyethylene bag, 2.5 m in diameter and 16 m in length, anchored securely in the bay about 1 km from shore. Scuba divers sink the bag in 20 m of water, then, holding its mouth open, swim to the surface capturing about 66,000 liters of undisturbed ocean water." The bag then becomes a kind of giant test tube enclosing the bay's natural population of small plants and animals.

China and Canada have a number of marine pollution problems in common. "The most important pollutant in Chinese coastal waters," says Jinping, "is crude oil, because crude oil exploration and transport are increasing from north to south with industrialization." The MEEEs are powerful tools to study the effects of oil spills.

In an oil spill experiment, dispersant chemicals and crude oil are added to the bags in quantities that would simulate a real-life spill. Then, observation and laboratory analysis reveal how the ocean and the food chain handle the stress imposed upon them.

Other coastal management problems that are shared by Canada and China and are being studied using MEEEs include toxic waste from industry, city waste water, agricultural pesticides from rivers, heavy metals churned up during dredging, and, of increasing concern, waste water from nuclear power stations. Referring to the last-mentioned issue, Jinping asks: "How many radioisotopes will be put on the table in China with seafood?"

As for the future of coastal pollution management, "We need to set up an

environmental protection service," says Jinping. "We need marine law." More specifically, and closer to home and heart, is the need for more training and technology to continue the experiments in Xiamen. "In future, Xiamen's Third Institute of Oceanography will be the central national laboratory to aid developing Pacific countries. We now need techniques and new ideas more than equipment."

The finale of the IDRC-supported MEEE program will be staged in Beijing in May 1987. Scientists from around the globe will join in a symposium to exchange ideas and discuss problems. A new plateau in marine science will be reached by China.

Looking back over the four years of work, Jinping agrees that much has been accomplished. Laboratories were built and equipped with modern instrumentation, 40 people were trained and are working in these labs, and 15 papers are being written and published on the Xiamen experiments. Perhaps most important, China and Canada worked in harmony towards keeping the marine environment healthy.

Jinping sits quietly on the old whitewashed veranda of his home by the sea, reflecting on his imminent return to China. His suitcases will be heavy with the weight of the literature he has collected to read, but his heart will be light with the happy memories of his work and friends in Canada. □



Jinping Wu examines the giant marine test tube.

Photo: Julie Henderson

Julie Henderson is with the Ocean Chemistry Division of the Institute of Ocean Sciences in Sidney, British Columbia, and is also a freelance writer.

PREDICTING FAMINE

Survival stories of Sudanese and Chadian drought refugees are rich in information that could help authorities to predict famine earlier and more accurately. A 1986 study conducted by researchers at the London School of Hygiene and Tropical Medicine shows that some typical human responses to drought, such as selling off livestock, are useful "early warning" indicators.

By GERRY TOOMEY

As Africans recover from the devastating drought and famine of 1984–85, efforts are concentrated on food policy, food security, and better farm technology. Governments and relief agencies alike have their fingers crossed that improvements in these areas, along with better weather, will prevent a recurrence of human tragedy.

But what if drought does return to again suffocate the Sahel and other regions? Earlier and more accurate prediction of the effects of drought on people would enable authorities to respond faster and more efficiently to the threat of famine and refugee migration.

With IDRC financial support, a group of researchers at the Food Emergencies Research Unit (FERU) of the London School of Hygiene and Tropical Medicine has been working on the problem. In 1986, they interviewed two groups of African refugees. One group of respondents consisted of 159 households from among 17 000 Chadians who had migrated across the border to a refugee camp in western Sudan. The other group was Sudanese, a total of 151 households from among nomads who had migrated south to the town of Omdurman near the Sudanese capital, Khartoum.

The results of the study suggest that a number of human responses to drought, such as selling off livestock and personal possessions and taking out loans, are useful famine indicators.

Emergency planners currently have two kinds of famine warning system available to them. One is based on observed rainfall and crop data. The problem here is that different groups respond differently to drought-induced crop failure. Some refugees suffered as much as eight years of drought and three years of crop failure before being forced to migrate, according to a previous FERU study.



Photo: Neil McKee

By predicting a food emergency solely on the basis of crop and weather data, authorities run the risk of "crying wolf at the inappropriate moment", note the researchers. They cite the case of Lesotho in 1983 when an emergency was declared using such information. "Various donor agencies responded only to conclude, too late, that no real emergency existed."

The second possible famine warning system is based on the nutritional status of communities. The difficulty with it, say the FERU researchers, is that such detailed information is rarely available and is costly to collect. Furthermore, such information is not particularly useful in an *early warning* system because by the time nutritional deterioration is detected, the need for immediate aid is already obvious.

The FERU study suggests that certain easily monitored human behavioural patterns could form the basis of an early warning system specific enough to pinpoint which communities are overstressed by drought. Emergency aid could then be distributed to the affected area before distress migration occurs. The following were considered useful indicators:

- **Migration.** Abnormal increases in labour migration, particularly whole households, are significant. "Early increases may be a trickle, but can act as an important indicator of a later flood."
- **Livestock sales.** The volume of sales goes up; prices go down. Patterns of sales according to animal species, age, and sex also change, reflecting the need to keep drought-tolerant animals that provide milk and meat, and the need to sell others for cash to buy grain. Cattle tend to be sold first as they do not tolerate drought as well as goats or camels.

- **Sales of capital assets.** Once livestock prices collapse, people are forced to sell household and farm goods as well as more personal items such as jewelry. Larger objects such as beds and farm tools are usually sold first, just before stress migration. Highly valued objects such as korans and jewelry are sold later en route.

- **Consumption of wild foods.** Diets are increasingly supplemented with wild foods which are foraged or bought in the market. This is an early response to drought. In some cases, drought victims survive solely on such foods for as long as three months.

- **Loans.** More loans are taken out by those under stress, usually just before they migrate. Relatives and merchants are usually the lenders. A decrease in the rate of debt repayment is also a valuable indicator.

- **Grain and livestock prices.** Grain prices skyrocket because of the declining food supply. Livestock prices decline because of the market glut caused by distress selling.

"The main findings of the study," the researchers note, "conform to those of other similar studies." They caution, however, that their results may apply only to the particular groups and drought period they studied. If relief workers are to use the indicators to plan aid dispersal, they should do so in light of area-specific factors such as the agricultural resources available to those affected by drought, family size and makeup, and tribal support systems capable of easing the effects of drought.

Given the importance of such work in the development of an effective early warning famine prediction system, IDRC and FERU are now discussing possible support for additional research. □

Saleable Seeds

The seed literally is vegetable seed. So is the harvest, a potential replacement for the 30 percent of their seed requirements that Thai farmers now import.

But the real targets of the efforts to grow vegetable seeds in isolated mountain valleys are not lowland farmers, but the hilltribes, whose traditional lifestyles have been disrupted in recent years. The dozen or so ethnic groups that inhabit not only the hills around Chiang Mai in northern Thailand, but also neighbouring Burma and Laos, came to the region in recent centuries.

Traditionally, they practiced slash-and-burn or other "swidden" farming methods, which involved clearing a field out of the forest and farming it for a certain time before shifting to another area. In addition to food crops, some of the tribes planted opium—originally just for their own consumption and then more and more as a cash crop.

As the Thai population and economy expanded, so did pressure on agricultural land. Lowland Thais who have been pushed off their land now constitute the largest group practicing swidden cultivation.

resulted in attempts by the Thai government to stop shifting cultivation by all groups. The government also wants the hilltribes to settle as part of its campaign to secure its borders with Laos and Burma. Another part of that campaign has been an effort to stamp out opium cash cropping.

Over the years, there have been several attempts, often under the patronage of the Thai king, to introduce new crops in hilltribe regions. Nuts, bamboo, spices, cereals, and medicinal plants have all been tested for suitability. The reason vegetable seed production may catch on is that, like opium, it has a high value per unit weight or volume. This is important in the many hilltribe areas inaccessible by road.

The four-year-old vegetable seed project, which is funded by IDRC, is associated with the Royal King's Project. It is directed by Chiang Mai University horticulturalist Dr Manee Wivutvongvana. She is assisted by her colleague at the university, plant pathologist Pipob Lumyong.

Dr Manee is a busy woman. Her work is constantly interrupted by calls on the two telephones on her desk about an international conference she is organizing or about her own private project to get volunteer doctors and nurses to visit the hilltribes.

"If you tell them (the hilltribes) that today we will teach you some agriculture, maybe 20 will come," Dr Manee said. "If you tell them the doctor will come, there will be hundreds and hundreds."

The vegetable seed project involves a study of growing conditions, screening trials for both local and introduced vegetable varieties, and training of the local Karen and Hmong people in crop management and extension work.

The project has two research stations. One is at Hoay Luk, a 90-minute drive north of Chiang Mai. The station is in a government land estate which has been divided up among local Karen, Hmong, and Thais who had no land.

Dr Manee selected the Hoay Luk site to test the performance of crops at an elevation of 600 m. The area is actually well serviced by roads, but there are other areas at the same elevation that are very isolated.

The second research station is 1300 m up Doi Inthanon mountain, a two-hour automobile ride southwest of Chiang Mai. The road passes first through villages of typical wooden Thai homes on stilts and along paddy fields dotted with groves of palms. Water buffalo graze on tender shoots of grass or wallow in the cool, muddy waters of the irrigation canals.

Eventually, the flat plain rises into the rolling foothills surrounding Doi Inthanon. Forest

Growing vegetable seed could put cash in the pockets of Thai farmers and help to undermine the opium trade.

By MARK TIMM

On the slopes of Doi Inthanon, Thailand's highest mountain, scientists are planting the seed of an improved way of life for the tribal peoples who dwell in the surrounding forested hills.

CAMPAIGN AGAINST SHIFTING CULTIVATION

The need to bring more land under permanent cultivation, in conjunction with the growing problems of deforestation and soil erosion caused by swidden agriculture, has



Left, a group of farmers prepare the soil for planting. Right, station chief Hoay Haeng and project officer Manee Wivutvongvana overlook the hilly Thailand site



replaces fields; banana trees and coconut palms give way to pines.

On either side of the road are little clusters of Hmong or Karen huts surrounded by terraced and occasional swidden fields. Finally, one comes to Krung Klang village, tucked against a sheer cliff that climbs to the peak of Doi Inthanon. In the background is the soft music of the Siriporn waterfall which feeds both the mountain streams and the research station fields.

The Doi Inthanon station is divided into two sites. One is at Krung Klang village. The other is called Hoay Haeng, which means dry brook, an apt name given the condition of the dirt road that one travels to get there.

There are currently three cropping practices used by the hill farmers. Some cultivate corn from May to September, opium from October to December, and vegetables from January to February. Others grow paddy rice from May to December. Still others grow upland (non-irrigated) rice and vegetables during the same months.

OPIUM SUBSTITUTE

Vegetable seed production can fit into this cropping system in two ways. In upland areas, the best time to start growing seed crops is in October, the very month when the corn growers traditionally plant opium. Secondly, because the paddy fields are fertile and irrigated, researchers on the vegetable seed project are experimenting with early maturing paddy rice varieties in the hope that vegetable seeds can be planted after the rice crop, as early as October.

Above all, the researchers are trying not to disrupt existing rice cultivation because, even now, the hilltribe farmers grow only 60 percent of their rice requirement themselves.

The project has had some setbacks. In one instance, birds ate the seeds the first year that Chinese radish was planted. In another case, an attempt to intercrop leaf mustard with opium failed: mustard yields were insignificant.

Problems of a cultural nature have also arisen. The first attempts to teach the hilltribes about the project failed because the lessons were in the form of complex lectures given in Thai, a language many of the farmers didn't understand.

Another challenge has involved the roles of men and women in the project. Dr Manee expects the project to be most successful in areas with high female populations since Hmong and Karen women are more skilled at intensive agriculture than the men. Yet it is the men who come for training—but not because the women are uninterested. "The men don't like to send the women because they want them to stay at home to do the

cooking and look after the children," Dr Manee explained.

The general pattern of the project has been one of progress. Both cabbage and tomatoes have been grown successfully, although the latter are still being tested for disease resistance. A foundation seed farm for Chinese radish was started in 1986. Its harvests will be given to hilltribe farmers who will produce from it certified seed for commercial sale. Leaf mustard is also being test grown on fallow paddy fields.

FARMERS KNOW TEST VARIETIES

There have not yet been formal surveys of the hilltribe farmers to see whether vegetable seed production appeals to them. However, Dr Chantaboon Sutthi, an agriculturalist at the Tribal Research Institute in Chiang Mai, said the crops Dr Manee is testing have the best chance of acceptance. "The hilltribes are familiar with these kinds of plants, so it's not a problem for them," he said. "The problem is with the crops they don't know." (Attempts to introduce flower breeding to the hilltribes have been a failure largely for this reason.)

Ultimately, the commercial viability of vegetable seed production in the remote hills of northern Thailand will have to be proved. There is currently no large-scale seed production in Thailand for any of the crops being tested by Dr Manee. However, she says there is a proven market for "thousands of tonnes" of leaf mustard, chinese radish, cabbage, and other seed.

Dr Manee has begun to consult seed companies for market advice and for donations of parental seed lines for field testing. Because she thinks highland seed production may even have export potential, she has also begun approaching American and European seed companies in an effort to interest them in the low labour costs the hill tribes can offer.

In Thailand, Dr Manee has been consulting for the past two years with the Chia Tai Co., Ltd. "Dr Manee knows her varieties; we know the potential of the market," said Manas Chiarabanond, the company's Bangkok-based general manager.

"Now we are testing her seed to see if it meets the needs of the market. In return, we could be the marketing arm for the product. It's good for everybody. It's good for the country." □

Mark Timm is a Canadian freelance journalist who writes on Southeast Asian affairs for several North American, British, and Asian publications. His special interests are politics and development.

COVERING A ANGLES IN T



By CAROL VLASSOFF

How does one bring about change? Should one increase the number of separate efforts made in villages, link them together, or formulate a long-term plan? Somewhere among these options the answer probably lies. That, at least, is what is expected to emerge from the work of researchers at Mahidol University. They are trying, with financial support from IDRC, to evaluate the results of an integrated development program involving a group of 40 villages in northeastern Thailand.

The work being done in these villages is, in some ways, unique. A local NGO, the Population and Community Development Association (PDA), launched this ambitious project although its experience had been mainly in family planning. PDA's development workers thought they would be able to bring about change only if they improved simultaneously both the social services

offered and the general environment, and encouraged villagers to produce goods at a profit.

In 1981, PDA put the first phase of its Community Based Integrated Rural Development (CBIRD) project into operation in two provinces in northeastern Thailand.

In 1984 the Canadian International Development Agency (CIDA) took over from Agro-Action, the German NGO that funded the first phase of the project.

The 40 villages selected are in the Nangrong District of Buriram Province, one of the poorest areas of northeastern Thailand. Subsistence farming supports 80 percent of the families in the area. There is no irrigation and the climate is relatively dry. About 60 percent of the children suffer from malnutrition, and many women die during childbirth—the rate is 70 percent above the national average.

The CBIRD project, now being evaluated by the Institute for Population and Social Research (IPSR) at Mahidol University, is based on improving the standard of living of the villagers. It has several components: agricultural technical assistance programs; financial assistance in the form of interest free loans for equipment, high-yield seeds, and livestock feed; marketing assistance (by set-

The villages have undergone considerable change since the windpumps have brought water. The pictures show several new industries (clockwise) brick making, duck breeding, egg production, pig farming and fish farming. (Photos: Neill McKee)

L THE AILAND



ting a minimum price for farm products); setting up industries such as silk weaving and food processing; a community sanitation and family planning program; and the establishment of a development fund for village undertakings. The hope is that this package of measures will increase the villagers' incomes, encouraging them to start new enterprises.

Such an experiment, however, must be constantly monitored and evaluated in the communities if those involved hope to learn from it. IDRC offered its assistance to the IPSR research team for such an evaluation. In December 1985, IPSR held a seminar on its work and the evaluation team produced its first report in May 1986. The final results are expected in 1987. *The IDRC Reports* will keep its readers informed of the progress of this project.

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Photo: IDRC

By FAWZY KISHK and
ROBERT CHARBONNEAU

Fernando tills his field in Colombia. The land, as in most of tropical Latin America, is infertile and acid. Thousands of kilometres away in North Africa, another farmer, Mustafa, is getting ready to plant his beans in the sandy calcareous, and mostly alkaline, soils of northern Egypt. He too has a tiny plot of land.

Both men are poor, subsistence farmers and really cannot afford expensive inputs such as fertilizers. But they have no choice. Like millions of peasants around the world, they must add fertilizers to their soil if they hope for a decent harvest to make a little profit or break even.

Mustafa and Fernando have heard from the extension specialists that plants need several elements. They know about nitrogen, potassium, and phosphorus as elements often added to the soil to maintain soil fertility and to improve productivity. Crops drain the soil of potassium, but it is in abundance in their soils and seldom represents a problem.

The extension specialists have also told them that nitrogen is found in nature in unlimited amounts. Some crops such as legumes recycle atmospheric nitrogen. But it is phosphorus that is the most limiting essential element under their soil conditions.

Worldwide reserves of phosphates (phosphorus rich compounds) are limited. If they continue to be used at the present rate they will not last more than 600 years. They constitute a valuable, nonrenewable resource. There are rock phosphate deposits in many parts of the world—in Colombia, Brazil, Peru, and Venezuela in Latin America, and in Morocco, Togo, Senegal, Tanzania, and Upper Volta in Africa.

The major exporting countries, such as Morocco, are aware of the fact that deposits are wearing thin and the cost of exploitation is rising steeply.

Rock phosphates are converted into soluble phosphatic fertilizers, such as superphosphate, through industrial processing. The cost of such fertilizers can be prohibi-

tively expensive for a small farmer such as Fernando or Mustafa. But peasants cannot do without phosphate fertilizers. Every time they prepare the land for planting, they apply fertilizer, which seems to disappear as if by magic, leaving little or no residual effect for the next crop.

FERNANDO'S DILEMMA

Fernando's soil is infertile and lacks phosphorus in a form his plants can use. He therefore applies phosphate fertilizer to this strongly acid soil but unfortunately the added phosphorus quickly disappears. Where does it go?

The problem is that tropical acid soils contain large percentages of certain iron and aluminium oxides. These react with phosphorus, fixing it in a form not readily available to the plants. The more of this expensive fertilizer Fernando adds, the more he loses. His soil is like a bottomless pit. Could he have used an alternative cheaper source of phosphate, one that does not vanish as quickly from the soil?

This question is the subject of IDRC-supported research being undertaken by the International Centre for Tropical Agriculture (CIAT) in Colombia and the International Fertilizer Development Center (IFDC) in the

USA. Researchers at both institutions are exploring ways of developing less expensive phosphorus sources, such as the direct application of rock phosphates to the soil.

The hypothesis is simple: since rock phosphates are converted by manufacturers into soluble phosphatic fertilizers by acidification, it follows that the excess acids in the soil should have the same effect on the rock. The strong acidity of the tropical soil can thus be used to slowly dissolve crushed rock phosphates and gradually release phosphorus for use by plants. This slow release could have a long-lasting effect on the soil, since degradation of the rock will continue with time. In Colombia scientists are busy developing an overall phosphorus management strategy for acid soils. It calls for the use of alternative sources of phosphorus suitable for the various cropping systems in the different parts of the country.

THE CASE OF NORTH AFRICA

Near Alexandria, in those arid lands typical of North Africa and the Mediterranean, Mustafa is getting ready, like everyone else, to spread superphosphate on the land. What he may not realize is that his soil, which has been receiving phosphatic fertilizers for many years, may already be saturated with



Photo: Neil McKee

IN SEARCH OF LOST FERTILITY

phosphorus. But since Mustafa does not want to take any chances, he buys and uses more fertilizer than he actually needs.

Mustafa has a reason to suspect troubles if he does not apply fertilizer. His soil, being highly calcareous, represents a special problem for phosphorus. As in the case of Fernando's soil, Mustafa's tends to fix the added phosphorus and render it unavailable to plants. The chemical mechanisms, however, are different in each case.

Mustafa is a powerless victim. He is sitting on top of a veritable storehouse of phosphatic fertilizer. He spreads 350 kilograms of superphosphate on each hectare of his land at every harvest. The Egyptian government sells fertilizers to farmers at a subsidized price, but the subsidy applies only to the first 250 kilograms per hectare.

Mustafa is absolutely convinced that the quantity provided to him at the subsidized price is insufficient. Advertising encourages him in this attitude. Better to use a little too much than too little, he reasons.

A few weeks after the superphosphate fertilizers have been spread on the land, they have crystallized because of contact with the alkaline soil (a process different from the one going on in Colombia). Unless plant roots come directly into contact with the phosphate granules, the fertilizer remains inert. In practice, the chances of such contacts are slim. There is therefore little benefit to the plants and Mustafa repeats the operation at each harvest.

Researchers at the University of Alexandria, under the direction of Professors F. Amer and A. Monem Baalba, have been studying this problem. But it isn't easy to find an answer. In Egypt, as in Colombia, it is the soil which is the active element.

In crystal form, superphosphates are insoluble, and hence the phosphorus they contain is not readily available to plants. A large fortune spent by Mustafa has sunk irretrievably into the ground.

In this desert country, where immense efforts are being made to grow crops, some soils consist mainly of infertile coarse sand. This simply compounds the crystallization problem. The phosphates sink in rapidly, beyond the reach of roots. This represents a permanent loss—unless of course the researchers at the University of Alexandria can come up with an answer.

The results of their research, which have been passed on to the Egyptian Ministry of

Agriculture, have already demonstrated the absurdity of the situation and the excessive costs involved in this unrestrained use of fertilizers. It isn't economically feasible to evaluate each plot of land, but recommended maximum phosphate levels consistent with maintaining yields and preserving soil fertility have at least been set. In the Nile Valley, where the soil is richer in clay and more fertile, the upper limit is 250 kilograms per hectare. In the desert areas the recommended rate is slightly higher.

Professors Amer and Baalba and their team, with help from IDRC, have begun laboratory research to try to find mixtures that would protect phosphates against rapid crystallization in calcareous soils.

They have discovered that pyrophosphates (pyrophosphoric acid salts), for example, crystallize more slowly and are therefore able to supply the phosphorus requirements of plants for a longer period before becoming inert.

INHIBITING CRYSTALLIZATION

A number of other ways of slowing down or preventing the crystallization of phosphates have also been explored. In a number of industries, special compounds are used to inhibit the formation of crystals (scaling) in boilers. In the pharmaceuticals industry, other products are used to prevent saline eye solutions from crystallizing. Could a way be found to use these or similar substances in agriculture to prevent or slow down the crystallization of phosphorus? Is there an economically practical way of coating superphosphate granules so as to slow down the surface contact with the soil and retard crystallization? In industry it has been easy enough to find ways of countering the phenomenon of crystallization, but an agricultural answer is more complicated because a number of factors act simultaneously in the soil.

The University of Alexandria researchers have experimented with all these ideas. Their research is on the right track and they now know a lot more about the crystallization of phosphates in soil. However, there are still many unanswered questions and more work is needed.

On his little parcel of land, now a treasure trove of unusable phosphates, Mustafa is eager to learn. As for Fernando, thousands of kilometres away, he is impatiently waiting

for a cheap phosphate source, such as rock phosphate, to become available on the local market. Then he will be able to make use of the acidity of his land to break down the phosphates. That will enable him to save the cost of expensive imported fertilizers. □

Dr Fawzy Kishk is Director of IDRC's Regional Office for the Middle East and North Africa. Robert Charbonneau is associate editor, responsible for Explore, the French edition of IDRC's magazine.

SOILS: ACID AND ALKALINE

Soils can be classified by their degree of acidity, known as pH. Neutral soils have a pH of 7. Those with a lower pH are acid; those with a higher pH are alkaline.

Most tropical soils are acid. The Amazon Basin, for example, consists almost entirely of oxisols (acid soils contaminated by ferric oxides) or ultisols which are also acid but contain more clay. Acid tropical soils are also common in equatorial Africa.

To combat acidity, farmers add lime. To restore soil fertility they apply superphosphates, which have been processed with acid.

Research at IFDC and CIAT suggests an alternative, namely the use of rock phosphate crushed to dust. This is broken down by the natural acidity of the soil and, in the process, fertilizes the soil. Other possible measures include the selection of plants that tolerate the natural acidity of the soil.

Alkaline soils are generally calcareous, sometimes sandy. These are commonly encountered along the shores of the Mediterranean. To make them more fertile, farmers add superphosphates which, because they have been acidified in manufacture, also help to normalize the pH of the soil.

Farmers also know from experience that manure reduces soil alkalinity, provides essential elements, and improves soil structure.

PROTECTING MALAYSIA'S RESOURCES

MANGROVES

AND FISH

By LIZA LINKLATER

Nestled away in a small office in a biology lab, Dr Ong Hin Eong sits behind his computer analyzing data that his research team has been collecting on mangrove forests over the previous three years.

The Universiti Sains Malaysia, on the island of Penang on the northwest coast of Malaysia, sits on the site of a former British army base among rolling hills. At the university's School of Biological Sciences, Dr Ong and his team are busy conducting research on the importance of mangrove forests to the neighbouring ecosystem.

Mangroves are tropical and subtropical trees that form dense thickets or forest along tidal estuaries, in salt marshes and on muddy coasts. They are composed chiefly of shrubs or small trees some of whose roots are visible above water. About one-third (about 4.5 million hectares) of the world's mangrove forests grow in Southeast Asia.

The Malaysian mangroves have contributed to the socioeconomic development of the country, mainly along the coast. They have been a traditional source of charcoal, fishing stakes, house supports, firewood, bark for tannin, and, recently, wood pulp.

"The Forest Department governs all the mangroves in Malaysia," says Dr Ong. "Every 30 years they are cut for charcoal and then replanted. They are a renewable resource.

"Most people think mangrove forests are wasteland," he says. His team, the Mangrove Ecosystem Research Group, is trying to prove the opposite, namely that the mangroves serve an important natural function. It has been shown, for instance, that many coastal fish have a high percentage of man-

grove detritus (debris from its leaves, flowers, and branches) in their gut. This suggests that the coastal fishery is highly dependent on the mangrove ecosystem.

Recently, there has been growing conflict over the use of mangrove lands. "Often mangrove areas are filled in and the land is converted to industrial or agricultural use such as rice fields because it is so cheap," explains Dr Ong. In Penang, the present-day airport was built on land that was once the site of an immense mangrove forest.

Fish ponds or farms are one of the most common uses of mangrove waters. Dr Ong says this has sometimes had a devastating effect on the stability of the mangrove ecosystem. He cites an example in the Philippines: "After the first few years, if the fish ponds didn't produce, the site would be abandoned and the soil would become oxidized, acidic, and unsuitable for most purposes. "Such practices are also threatening the livelihood of people in the coastal communities who have traditionally depended on the mangroves for their income.

In Peninsular Malaysia, about 20 percent of the mangroves have been "reclaimed" over the last 20 years. For each new intensive-aquaculture project, 100 or more hectares of mangrove are cut, according to Dr Ong.

The long-term objective of the IDRC-funded project is to determine the degree of dependence of coastal fisheries on mangroves as well as the extent to which the mangroves can be put to other uses without affecting those fisheries. In specific terms, the researchers will estimate the movement of mangrove litter and detritus within the mangrove system and its export into the surrounding coastal ecosystem.

Three times a year, in both wet and dry seasons, Dr Ong travels to the Sungai Merbok River, a 1½-hour drive north of Penang.

He is accompanied by three researchers and a large contingent of students. The group totals between 50 and 60 people. Members of the team camp out for three days and conduct their experiments in the mangroves which, in this area, cover 5000 hectares.

After hiring nine boats from local fishermen, the researchers are stationed at nine different locations across the one-kilometre-wide river mouth. Working in shifts, each five-person crew takes measurements every hour over a period of 36 hours, or three tides, and at different depths, from 2 to 15 metres. They monitor the materials going in and out of the water sampler. At the end of each expedition they bring back 1500 water samples to the lab.

Dr Ong says most of the equipment used in the experiments is hand-made and available locally. "We use a rock for an anchor, locally made floats, and make-shift vanes to measure the currents. The most expensive piece of equipment is a meter which we leave in the water for two to three weeks."

They monitor for particulate matter (litter, plankton, and detritus) and dissolved detritus (in the form of dissolved organic carbon). Then they follow up by measuring plant nutrients, chlorophyll, dissolved oxygen, pH, and light penetration.

"We will be able to discover the effect that rain, wind, tides, and currents have on organic matter and nutrients," explains Dr Ong. "This flux is important as far as fisheries are concerned. The results will enable us to tell the government the percentage of mangroves to keep and how much to cut for the prawn farms. We should have a model soon."

Liza Linklater is an Ottawa-based magazine writer and researcher. She visited the Universiti Sains Malaysia project in the spring of 1986.

Photo: Neill McKee





Photo: Dante de Padua

THAILAND'S VILLAGE RICE MILL

By GERRY TOOMEY

Like other rice growers, Thai farmers know that the quality of their finished product—and ultimately their profit—depend a great deal on proper drying, milling, and storage.

Unfortunately for them, postharvest losses can gobble up as much as one-quarter of the rice they grow. Causes range from improper drying and germination of kernels, to breakage during milling, to insect and rodent damage during storage.

Since 1975 IDRC has been providing funding to Thailand's Ministry of Agriculture and Cooperatives to solve these problems by improving drying, milling, and storage technologies. One of the most impressive advances to date has been the development of a small-scale rice mill for servicing the needs of villagers. It is a modified version of a popular, larger local design.

About eight years ago, the Ministry's Division of Agricultural Engineering (DAE) surveyed four regions of Thailand to determine, among other things, which kinds of mill were in use and how they were performing. The survey revealed 12 different types of machine. One of them, a locally designed "horizontal abrasive mill", was found to be in widespread use by rice millers in all four regions. Although it was designed as a single-pass mill, two or three passes were in fact needed to whiten the rice sufficiently.

The DAE team modified the mill and were encouraged by subsequent tests which rev-

ealed a doubling of efficiency. With IDRC support, DAE now is comparing the technical and economic efficiency of the modified mill with other traditional ones.

The original survey in Thailand also found that the second most popular device for milling unprocessed rice, or "paddy", was the single-pass "Engelberg" huller/whitener. (A huller or dehuller is any device for removing grain husks.) This machine, designed for commercial use, is simple and robust. But it has a number of disadvantages, the most serious being the high percentage of broken rice kernels due to its rough dehulling action.

The main component of the Engelberg design is a single cast iron cylinder with a bumpy surface that turns inside a metal casing. An adjustable steel blade mounted in the casing runs the length of the cylinder, very close to it. When the kernels of rice pass between the blade and the rotating cylinder, they are hulled by a sheering action and also whitened as the inside coat of bran is removed. This rough process results in a certain amount of breakage. As with some other mill designs, the rice often has to be sent through the mill more than once to remove all the bran.

The DAE modified rice mill overcomes these problems by using different materials and separating the milling process into two steps: hulling (to produce brown rice) and polishing (to produce the finer white rice). Two emery rollers, one above the other in separate casings, replace the steel cylinder used in the Engelberg design; a hard-rubber bar called a 'brake' replaces the steel blade. The emery-rubber combination makes for a more gentle treatment of the rice than the steel-steel combination, thus reducing breakage.

The first roller hulls the paddy. As the husks are drawn off by an aspirator to a

GENTLY, PLEASE

separate container, the hulled rice shoots through the mill to the second roller which is smaller and less abrasive. In this polishing operation, the last of the bran is rubbed off.

The result is high-quality white rice with few broken grains. As a bonus, the DAE model can be manufactured locally and is much less expensive than imported Japanese models.

AWARD-WINNING INVENTION

"The real trick in designing the mill was for the Thai researchers to synchronize the action of the first roller with that of the second," says Ed Weber, the associate director responsible for IDRC's Post-Production Systems Program. Since the first roller eliminates the husks and some of the bran, the second roller has a smaller load to handle and therefore has to be proportionately smaller.

In Thailand last year the DAE rice mill won an award for best agricultural machinery invention, and in Indonesia, where it was tested by the directorate of food crops, it was considered superior to local models. The World Food Programme was also impressed enough with the mill design to order the commercial manufacture of several mills for use in Africa.

In 1987, the researchers hope to propose one or more successful mill models for farm and village use.

Current field testing of the DAE rice mill is just one component of an overall IDRC-funded postharvest technology project valued at CA\$370 600. The research team is also testing and evaluating solar dryers, including one of their own designs, as well as working to improve rice storage techniques. □

PAYING THE PRICE

GONORRHEA IN THAILAND

By DENIS MARCHAND

"How am I supposed to track down cases of sexually transmitted diseases without the proper tools and diagnose them rapidly without any lab for analysis?" Nibba laments out loud. "Especially gonorrhea—in women the symptoms usually aren't obvious."

Nibba is a nurse in a little health centre in the District of Surin in northeastern Thailand. Sitting in the doctor's special chair, she reflects on her helplessness. The expression on her face is sad and her whole bearing shows defeat.

She glances at the equipment in the dispensary. It consists of a few anatomical prints on the walls, a stethoscope, a reflex hammer, an ophthalmoscope, a pediatric scale, an examination table, a closet containing packets of salt, analgesics and antimalaria drugs donated by international humanitarian agencies.

"What can I really do when a mother brings her baby in with a serious eye infection and she herself has problems which may be caused by untreated gonorrhea?"

As she sees it, her main day-to-day job is to reduce the major causes of infant deaths, which are all too common in the region. She gives people information about malnutrition, dehydration caused by vomiting or bad diarrhea, and sicknesses brought on by drinking contaminated water. She checks the weight and temperature of the children and whether they have had their vaccinations against various infectious diseases.

Since 68 percent of Thai women give birth in their homes, helped by their husband and a neighbour or midwife, Nibba is often called upon for this duty. She also takes care of

minor injuries and refers serious cases to the provincial general hospital—only the very serious cases in fact. Poor and indebted, the local farmers can't afford to travel to a major city to get care. As for the women, they can't go away. They have to take care of the children, fetch water from the well, cook the meals, and work in the fields. There is still no comprehensive and effective health care available to the rural people.

3 MILLION CASES

In Bangkok, the Thai capital, Dr Amnuay Trisupha, director of the department of sexually transmitted diseases (STDs) at the Banrak Hospital Centre, is worried. Recent research confirms that STDs are spreading at an alarming rate in Thailand. Out of a population of 50 million, studies show that 3 million are affected. There are 700 000 prostitutes and masseuses, mostly between the ages of 15 and 24. Some 70 percent are infected with an STD.

In the previous year, Dr Trisupha personally treated six cases of infant blindness due to infections contracted in childbirth from mothers suffering from untreated gonorrhea.

This frightening state of affairs persuaded Thailand's Minister of Health to set up a gonorrhea control program directed by Dr Trisupha. It is financially supported by IDRC. The phenomenal spread of STDs is probably due to the migration of people from one region to another, the liberalization of sexual mores, the lack of resources for STD detection in the provinces, and prostitution.

The impoverishment of the rural areas is forcing people to move into the cities and industrial or tourist areas where they try to pick up casual employment. But the high rate of unemployment stacks the odds against them. As a result, prostitution is the only source of income for increasing numbers of people.

THE WARRIOR'S REST

Prostitution has always existed, but in the 1960s it became a growth industry when six large U.S. military bases were installed in strategic locations along the borders. The bombers took off from them for raids on Vietnam. At one point there were about 40 000 men at these bases and they attracted tens of thousands of women who hoped to make money from prostitution.

To keep up troop morale and give the men a chance to forget the horrors while on leave, the U.S. armed forces set up a rest-and-



OF PROSTITUTION



recreation program in the surrounding countries. Local entrepreneurs built scores of hotels and bars to meet the enormous demand. The noble tradition of Asian massage became the pretext and screen for prostitution and the need for a constant supply of women became considerable.

Nowadays, the most obvious reminders of the Vietnamese War and GI rest and recreation are the beaches of Pattaya (where the 32 000 sailors of the 7th Fleet still take their rest) and Phatphong, the red light district of Bangkok.

The soldiers have been replaced by European, Australian, and Japanese tourists. Two million tourists visit Thailand every year and 60 percent of them admit their motive is exotic sex at a low price. Correcting this situation is difficult because of the country's chronic poverty. For most of the women involved, it is the only possible way to make a living, even if it does destroy their health.

STDs used to be most common in the big urban centres where there are hospitals and special clinics. Now they are ravaging the countryside where there are few, if any centres to track and treat them.

WOMEN AND CHILDREN FIRST

"Can one call it a panic? No, but there is good reason to be concerned and take the bull by the horns for the good of the whole community," says Dr Trisupha. "Our preliminary research shows that immediate action must be taken to look after the women and children, the most vulnerable victims, and to protect them against the serious complications that result from undetected and untreated gonorrhea. Some of the consequences are dramatic: infection of the fallopian tubes, high-risk pregnancies, female sterility, blindness in children, and systemic infection of future generations."

About 80 percent of Thailand's doctors practice in Bangkok which has a population of 5.2 million. The remaining few serve 50 000 villages and communities with about 45.2 million inhabitants.

Thailand does, however, have an extensive network of health centres. There are 95 provincial hospitals, 573 district hospitals, and 7000 small health centres. A structure does exist and what the Ministry of Health hopes to do is to provide every unit in the system with the tools needed to combat STDs, especially the most widespread, gonorrhea. To do this, it plans to set up close links between the various establishments and provide the relevant training for all health

personnel, including the staff at the small district hospitals and volunteers.

SIMPLE TECHNIQUES

Extensive research is being done to develop a simple, low-cost method of detection that does not require the presence of a specialist. Such a technology could easily be applied in all the regional health establishments.

Three years ago, the drugs came from Europe in the form of ready-to-use capsules. They cost seven times as much as those now used, which are made by the Banrak Institute in Bangkok. "That represents considerable progress," Dr Trisupha says. "It's even quite realistic to think of manufacturing it in provincial towns. Our research should get us to that point."

Another of the research program's objectives is to reach a point where biological cultures can be analyzed at small district hospitals. That would make it possible to save money (transport and administration) and increase the reliability of the tests, since the Thai climate makes sending samples any distance risky.

Reaching the lowest echelons of health personnel and the population as a whole is a formidable challenge in a developing country. The firm intention of the government to solve the problem, combined with the research in progress and the measures already taken, should stop the spread of gonorrhea, according to Dr Trisupha. He estimates that within two years efficient methods of detection, diagnosis, and treatment will be available in all regions of the country, and the population will be well informed about the causes, nature, and consequences of this contagious scourge.

However, although he doesn't seem to be overly disturbed by it, Dr Trisupha does mention the appearance of new strains of gonorrhea resistant to penicillin and requiring other kinds of medication or antibiotics too expensive for most of the population.

Now that this 'super-gonorrhea', as Dr Trisupha calls it, has appeared, the researchers have to be even more concerned about the cost of wiping out the disease and about finding money to continue with increasingly complex research. □

Denis Marchand is a Canadian freelance photographer and writer. He visited Asia under a project of the Fédération professionnelle de journalistes du Québec, financed by the Canadian International Development Agency.

Africa's charcoal dilemma

By PAUL-ANDRÉ ROCHON

During the last 20 years, charcoal moved up into first place as a domestic fuel in numerous African cities. People living in the capitals and other cities can't afford to pay for electricity or petroleum-based fuel and have remained loyal to charcoal. It is often less expensive than its closest competitor, firewood. Quite apart from the advantageous price, householders prefer it because it is cleaner and more compact than wood and can easily be broken into small pieces without the use of any tools.

So, it is hardly surprising that the popularity of charcoal increases constantly. In Kinshasa, Zaire, consumption has gone from 30 000 tonnes in 1970 to more than 120 000 currently. In Kigali, Rwanda, consumption quadrupled over the same period. In Nairobi, as almost everywhere else in Africa, a rapid and sustained increase in the demand for charcoal over the next few years is expected.

The popularity of 'amakala', the name for charcoal in Central Africa, is economically significant. The fact that 1.5 tonnes of charcoal yields as much energy as 1 tonne of petroleum means that charcoal use can make for considerable foreign currency savings for petroleum-importing countries. The cost of transportation brings the price of one tonne of petroleum to US\$100 in Kigali. Merely replacing the annual consumption of charcoal (20 000 tonnes in 1985) in that city by petroleum would cost one of the poorest countries on earth more than US\$1.3 million each year. Inevitably the cost would be borne by the numerous poor households of Kigali.

Apart from the savings in foreign currency, the trade in 'amakala' facilitates a sizable transfer of money from the city to the countryside. In Kibungo, for example, in eastern Rwanda, many charcoal makers have been able to replace the roofs of their

shacks with corrugated sheeting thanks to earnings from charcoal sales. In Kigali, as in most African cities, countless small traders eke out an existence from the sale of this fuel. Each district has one or more charcoal sellers who often offer home delivery. Throughout the continent, charcoal is produced in the remotest forests and delivered right to the consumer's doorstep.

Charcoal has become a genuine national small industry and the advantages it has to offer, particularly for low-income people, are often overlooked. It is well adapted to the sociocultural reality of African cities, it supplies a form of locally produced and marketed energy, and provides numerous jobs. Its future, however, is threatened.

Charcoal producers have been reluctant to use new technology because they don't have to pay for their raw material. There simply isn't as financial incentive to increase productivity as there would be if they had to buy their wood. Indeed, if the wood weren't

free, producers would be under pressure to get as much charcoal as possible from it and to investigate new methods.

It can be supposed that 'Casamance kilns'—an inexpensive technology that can double the output of traditional methods—would rapidly become popular with charcoal sellers who wanted to increase productivity. Recent trials in Senegal and Rwanda have, in fact, shown this to be true.

But charcoal producers do not have to buy their raw material and the 'saving' is passed on to urban consumers who buy the fuel for less than its real value. Consequently, the price of a kilogram of charcoal in the market in Abidjan or Bujumbura doesn't include the cost of reforestation.

The deforestation now ravaging both the Sahel and the areas surrounding equatorial Africa's capital cities threatens the survival of the charcoal industry. As a cause of deforestation in a number of African regions, charcoal production ranks just after farmland expansion and firewood consumption. Part of the problem is that current charcoal production methods waste a lot of wood. Most have not changed for decades or even



lemma

centuries. In the past these methods did not constitute a threat to the forests because the amount of charcoal produced was negligible. But massive urbanization has changed both the nature and the quantity of the demand without a concomitant evolution of production technology.

The stoves found in African urban households are also part of the problem. The most widely used types consume charcoal inefficiently and contribute to the wastage of increasingly scarce forest resources. It is now generally recognized that the low efficiency of the methods used both for producing and consuming charcoal contribute to the deforestation of rural producing areas. The ecological consequences range from erosion and decreasing productivity of the soil, to the much lamented desertification of the Sahel.

However, before damning charcoal out of hand, one should remember the definite advantages it can offer African countries—such as much needed employment and foreign currency savings.

Before dropping charcoal as a fuel, it would be wiser to take steps to improve its production and consumption.

By way of example, improved methods for burning wood to make charcoal have been available for several years. They can dou-

ble or even triple the amount of charcoal obtained by the traditional methods. And improved stoves which consume 40 percent less charcoal have been designed for use in urban households. Despite the urgency of preserving forest resources, however, their use is still, unfortunately, very limited.

It is generally admitted that the improvement of the present situation is not a question of developing better technology. The fact is that technological options already exist but haven't yet spread. Why not?

If there is to be any hope of growing back the forests that will supply the households of the future with charcoal, then the costs of reforestation must be recovered. In Kigali, the only increase in the price of charcoal was that resulting from increasing transportation costs as the forest was cut back farther and farther from the capital. Wood now has to be brought in from 160 kilometres away because of the lack of money for adequate reforestation around the capital.

Reforestation of the outskirts of other urban centres, such as Dakar, would considerably reduce transport costs. (Distances sometimes exceed 400 kilometres.) These savings would benefit consumers who are now paying for the shipping of charcoal.

Firewood is usually traded by barter, but charcoal is marketed commercially everywhere in Africa. The result is that both the supply and demand of this fuel are sensitive to price fluctuations. Any increase in the cost of production is inevitably transmitted to con-

sumers who could thus be forced to economize and use fuel sparingly by installing improved stoves. Any resulting drop in consumption would make up for the increase in the price of charcoal.

It is estimated that in Kinshasa alone charcoal consumption could be cut in half. However, the only way to achieve such reductions is through a policy that would require charcoal producers to pay for the wood they use. The price of charcoal in the cities would have to be gradually brought into line with the cost of renewing this natural resource. This would make essential reforestation possible.

Forests throughout Africa are a governmental responsibility. Consequently, in those African countries where wood supplies are threatened, it will have to be governments that adopt the proper pricing policies.

There will also be a need for information and publicity campaigns, dealing mainly with the new technologies available. These will help to win over the active participation of the target populations. It is even legitimate to hope that the peasants themselves will reforest their land if the price paid for charcoal in the cities makes it sufficiently attractive.

The present and future importance of charcoal demand provides the opportunity to modernize the industry in the rural areas and to introduce improved stoves in the cities. What is now at stake is the future of a resource of the utmost importance to the whole continent. □

Paul-André Rochon is a Canadian-based energy consultant.



Photos: Neil McKee

DIFFERENT COUNTRIES, DIFFERENT NEEDS

IDRC's view of plant breeders' rights

Over the years different forms of patent and copyright legislation have been enacted to protect the products of plant breeders' ingenuity and innovation (see box).

The opponents of plant breeders' rights (PBR) claim that whatever conventional methods of crossing, propagation, and selection are used, all of the genes involved occurred naturally and are therefore the common heritage of all mankind.

In 1983 a majority of the developing country members of the UN Food and Agriculture Organization (FAO) supported a resolution calling for worldwide access to all sources of germ plasm. (Germ plasm is a general term referring to any hereditary material—including seeds, cuttings, whole plants, or cell cultures—that can be used to multiply an organism.) The developing countries claim correctly that most of the world's germ plasm comes from their territories. It is a fact that few important edible crops are indigenous to North America—for example, blueberry, cranberry, Jerusalem artichoke, pecan, and sunflower.

An added complication lies in possible future interventions by genetic engineers and other biotechnologists. Their business, broadly speaking, is to juggle the genetic makeup of living organisms. By transferring genes, they confer upon the recipient organism desirable traits that it does not naturally possess.

Biotechnology companies now appear to be seeking an extension of protective legislation. Their argument is that an organism modified by the introduction of a foreign gene is unlike anything found in nature, and is therefore as

eligible for a patent as any other unnatural product or invention. They have gained hope from a patent granted to a company for a novel maize genotype produced through biotechnology. So there is now the added concern over what will happen if individual genes, as well as the plant life into which they are artificially introduced, become patentable.

FREE EXCHANGE OF GERM PLASM

It would be unfortunate if the enactment of plant breeders' rights were to restrict the free international exchange of germ plasm. The developing regions, in which most of the world's food crops originated, should not be deprived of access to essential breeding and planting materials. To

agreements such as the registration legislation covered by the Union for the Protection of New Varieties of Plants (UPOV), adopted by European countries in 1961.

Under the UPOV agreement, samples of released varieties can be made available for breeding, even when not available for multiplication. However, as breeding shifts to the private sector as a result of PBR, there is a danger that advanced lines and varieties with potential as parental material in developing countries will increasingly be locked up. Clearly this should be avoided. The continued and strong involvement of the public sector in plant breeding, even in countries that adopt PBR, may be one of the best ways to ensure free access to genetic resources.

The adoption of plant breeders' rights by developing countries is a matter of individual choice. They should not be pressured into it.

this end it would be advantageous if the comprehensive and definitive germ plasm collections are retained, protected, and distributed under the auspices of international institutions such as the International Board for Plant Genetic Resources (IBPGR). Subsidiary collections could be retained by national governments.

It is hoped that all released varieties, particularly those derived from germ plasm indigenous to developing countries, will also be made freely available to those countries. The issues relevant to licenced varieties are complex and may call for revisions to international

Recognizing the complexity of the PBR issue and unresolved conflicts surrounding it, IDRC's Board of Governors and management will continue to monitor the international situation. In the projects and programs it supports, IDRC will seek to promote and protect the free exchange and transfer of germ plasm and plant breeding materials and to ensure that the developing countries are in no way disadvantaged by actions and laws enacted elsewhere. IDRC will give the highest priority to national agricultural systems in developing countries, to the International Agricultural Research Centres (IARCs)

related to the Consultative Group on International Agricultural Research (CGIAR), to other cooperative research networks in developing countries, and to IBPGR. In IDRC's view, IBPGR remains the most effective mechanism for coordinating the international collection and protection of germ plasm.

The following paragraphs cite a number of plant breeding issues that seem particularly important to IDRC's Board of Governors and management.

APPROPRIATE FOR SOME

The adoption of PBR by developing countries is a matter of individual choice. PBR are probably appropriate for some countries and could help stimulate plant breeding activities with clear advantages to local farmers. In other countries, PBR might only exacerbate an existing situation of disadvantage.

Development agencies can help by providing impartial information on the advantages and disadvantages of PBR. Developing countries must not be pressured into establishing PBR by UPOV signatories, transnational companies, or others.

In countries with strong indigenous plant breeding programs, there may be clear advantages in adopting PBR. Indeed, several have already done so. In such cases, it is the policy of IDRC to cooperate, while at the same time stressing the importance of continued public sector plant breeding.

Some countries have weak plant breeding programs. The scientists may be poorly paid, the working locations isolated, and the facilities inadequate. In such cases it is IDRC's policy to support the establishment and strengthening of national agricultural research systems. In such countries there are few commercial opportunities for transnational or private companies and the PBR issue hardly arises.

A third group of countries lies somewhere in between. Public sector breeding has some strength and market prospects may interest private companies. If PBR are adopted in such situations, the most productive policy may be to apply the legislation so that both the public and private sectors have an equal opportunity of benefiting. This would encourage greater financial support and increase the amount of plant breeding. The private sector may play a valuable role in establishing good breeding and seed multiplication enterprises, and indeed may be attracted to do so without PBR legislation. However, care must be taken to ensure that the private sector does not come to dominate breeding efforts. Opportunities for abuse abound. The importance of maintaining a strong public sector is even greater than for developed countries.

There can be no possibility of PBR in any country until there is an organized seed industry with rigorous standards for seed multiplication, storage, dressing, packing, and distribution. Generally, such an industry is best handled by private enterprise. Governments, however, must ensure the maintenance of standards, certification of the seed crop in the field, and inspection of seed samples for impurities, germination, pests, and diseases.

Donor agencies need to assist developing countries in seed multiplication, seed licensing, and inspection services, as well as in the

training of staff for these specific purposes.

RIGHTS AND OBLIGATIONS OF UPOV MEMBERS

Membership in UPOV makes good sense for the developed world. It ensures high standards of testing for performance and quality, thus providing for a reputable and reliable international seed trade. UPOV also encourages free interchange of registered materials among its members.

For many developing countries, however, membership in the union may be inappropriate. Few countries have the necessary trained staff to carry out extensive testing of varieties and seed. In addition, they could become vulnerable to exploitation by transnational companies. The implications of joining UPOV should be exhaustively studied before any government considers membership.

CGIAR SYSTEM

The number of developing countries able to legislate, implement, and manage PBR is small. For the great majority, there will be few restrictions on seed movement, purchase, or sale. Seed materials will continue to be freely available from the CGIAR system.

Some observers have suggested that semifinished cultivars from the IARCs are susceptible to misappropriation in countries with PBR. These materials therefore need to be accurately

LEGISLATION THROUGH THE YEARS

In 1930 the U.S. Congress passed the Plant Patent Act (PPA) to protect plants reproduced asexually, that is, through cuttings and grafts rather than from seed. Congress restricted protection to vegetatively propagated clones since they are genetically identical from one generation to the next. In contrast, the progeny of sexual crosses are widely heterogeneous. Congress also excluded plants such as potatoes, whose asexually reproducing parts are edible. PPA forbids breeders other than the patentor to reproduce the patented plant asexually. Others may, however, use the protected variety as a parent in a sexual cross.

In Europe, more than 60 years ago, France registered seeds by variety and breeder. Only registered varieties could be sold, thus establishing de facto plant breeders' rights. In 1961 the Union for the Protection of New Varieties of Plants (UPOV) standardized such registration legislation throughout Europe.

In 1970, the U.S. Plant Variety Protection Act (PVPA) extended a form of patent protection to sexually reproduced plants. This recognized the fact that through diligent crossing and selection, breeders could produce identifiable, uniform, and stable varieties. PVPA awards protection certificates for 18 years. More than 1600 protection certificates have been awarded under PVPA. The Act does not prevent a farmer using some of this year's harvest as planting seed in the next season.

described, and the descriptions widely publicized. Appropriate agreements need to be made with governments of the countries concerned. Not inconceivably, the dangers associated with misappropriation may be greatest in countries that join UPOV.

These concerns may however be more imaginary than real. A country that has introduced PBR legislation most often has reached an advanced stage in plant breeding and has less need of semifinished materials. The IARCs' primary clients are those with a less developed capability who would not likely have adopted PBR legislation.

RESTRICTIONS AND COUNTER-RESTRICTIONS

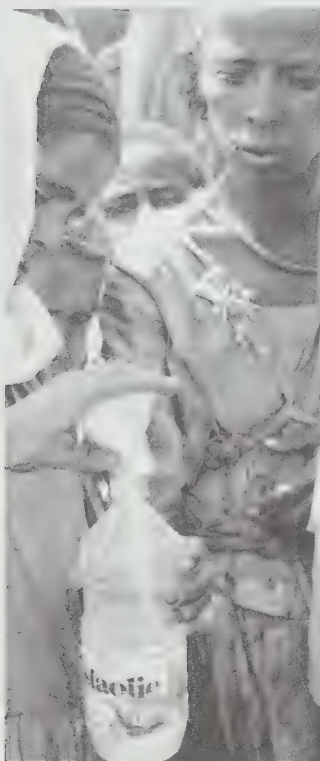
Plant breeding is most effective when done from a wide base of genetic resources

and when testing of improved lines is carried out across diverse locations. The international exchange of germ plasm is therefore an important element in the development of good breeding strategies for both developing and developed countries.

As legislation restricting access to new varieties is increasingly adopted, developing countries can likewise be expected to tighten access to the genetic resources available on their home turf. Indeed, many now argue that their indigenous germ plasm is a national resource—like forests or mineral deposits—to be exploited commercially. While understandable, such an attitude, like the introduction of PBR, could result in greater restrictions on the movement of germ plasm. Clearly, this could be counterproductive for all concerned. The situation needs to be monitored carefully. □

ACRONYMS

PBR	— Plant Breeders' Rights
CGIAR	— Consultative Group on International Agricultural Research
FAO	— Food and Agriculture Organization
IARCs	— International Agricultural Research Centres belonging to the CGIAR system
IBPGR	— International Board for Plant Genetic Resources
UPOV	— Union for the Protection of New Varieties of Plants



State of the World's Children

The 1987 State of the World's Children report, published by the United Nations Children's Fund (UNICEF), describes continuing achievements in child health around the world. But the report, the publication of which coincides with UNICEF's fortieth anniversary, is also tempered with sobering statistics about the improvements that still need to be made.

At the international launch of the report last December in Ottawa, UNICEF Executive Director James Grant referred to the "silent emergency" that still grips the world—the fact that some 280 000 children die each week of largely preventable diseases such as diarrhea.

"These children are not dying of exotic diseases that require expensive cures," said Mr Grant during a press conference. "They are dying of things that can be prevented relatively easily, relatively cheaply. Surely the time has come to put the needless mass deaths of children on the shelf along with racism, colonialism, and slavery."

Despite the desperate need for further improve-

ments in child health, there has been dramatic progress, according to the report. "Within the last 12 months the increasing outreach of just two... low-cost methods—immunization and oral rehydration therapy (ORT)—has saved the lives of an estimated 1.5 million children under the age of five."

Egypt and Turkey are cited as major success stories.

Three years ago dehydration due to diarrhea was the leading killer of young children in Egypt. Yet less than one percent of Egyptian mothers were using ORT to treat their children. Within two years of the launch of a massive ORT information campaign in 1984, an astounding 82 percent of mothers said they used the treatment when their children had diarrhea.

In Turkey, a major vaccination campaign at the end of 1985 is credited with saving the lives of 22 000 children.

According to the report's statistical tables, the percentage of children in Egypt who survive to age five grew from 70 percent in 1960 to 86.4 percent in 1985. Comparable figures for Turkey were 74.2 percent and 89.6 percent respectively.

The UNICEF press conference was also the occasion chosen by Canadian Prime Minister Brian Mulroney to announce a four-year CA\$36.5 million grant in support of India's immunization program. Canada is currently the largest supplier of vaccines to the world's immunization programs.

Prescription for Health

World sales of the English and French versions of IDRC's award-winning film *Prescription for Health* now total about 400.

Released in late 1983, the film describes the route of water-borne diseases, as well as the personal hygiene and community practices that can help eliminate them. Diseases such as diarrhea, typhoid, and cholera annually kill millions of Third World people, mostly children.

Prescription for Health, which was produced jointly by IDRC, the World Health Organization, and Oxfam, is aimed primarily at health workers and water-and-sanitation technicians and engineers in developing countries. "It has also proven very popular right down to the grass roots," says Neill McKee, IDRC's film producer/director.

Through cooperation between IDRC and various sponsoring agencies, the film is also now available in Spanish, Tagalog, Waray, Cebuano, Malay, Indonesian, Thai, Bangla, Tamil, Sinhala, Hindi, and six Micronesian languages. Kiswahili, Amharic, and Burmese versions are under production, as are written support materials.

The film may be borrowed from IDRC offices and from most Canadian embassies or High Commissions in developing countries. For information on video and 16mm film purchases, contact IDRC. Addresses are listed at the bottom of page 2.

'It pays to invest in the environment'

The 1986 State of the Environment report by the Nairobi-based United Nations Environment Programme (UNEP) examines the inseparable interconnections between environment, development, and health.

"If the environment is abused, both health and development suffer," says the report. "... if nations do not develop, poverty condemns their people to continual disease, debility and early death, and drives them to destroy their environment in their desperate attempt to survive."

The report contains an overview of how "environmental degradation is undermining development and damaging human health." The problems discussed include: the relation between waterborne diseases, such as diarrhea and schistosomiasis, and water pollution; the negative health effects of

chemical fertilizers and pesticides; damage caused by the production and use of energy; pollution caused by industries and by chemical and toxic wastes; and the ill effects of rapid urban growth.

To solve these problems, states the report, governments must spend more money on preventing and controlling environmental damage. They need to realize that it pays to invest in a healthy environment.

"The Government of Venezuela, for example, found on occasion that the provision of clean water paid for itself five to eleven times over in increased productivity that better health brought to the work-force."

The UNEP report stresses that government decision-makers must build environmental concerns into the development process right from the conceptual stage.

Lorne Peterson
Ottawa

Fertilizer R&D in Africa

The International Fertilizer Development Center (IFDC), based in Alabama, USA, reports progress in the establishment in Togo of an "Africa Center" for fertilizer research and development.

Dr Paul L.G. Vlek, an IFDC soil scientist, has been appointed to head IFDC's Africa Center. He begins his tenure this year.

The Government of Togo has donated 12 hectares of land outside the capital Lomé to house the new R&D facility and IFDC is currently seeking donor support. Initial program support has been pledged by IDRC, the World Bank, the Rockefeller Foundation, the United Nations Development Programme, and the Dutch Government.

The Africa Center's goal is to increase food production by overcoming the constraints to fertilizer use and to promote the exploitation of locally available fertilizer resources. As part of its work, the Center will train Africans in fertilizer production, marketing, and use. □

Teaching Children of the Poor: An Ethnographic Study in Latin America

Editor: Beatrice Avalos.
IDRC-253e. 175 pp

This is a book about teachers, teaching, and learners in poor environments of four Latin American countries: Bolivia, Chile, Colombia, and Venezuela. The study on which this book is based involved the observation of rural and urban schools at different periods during a school year. It provided knowledge about processes related to failure experiences of children during their first years in school. The book presents a vivid picture of styles of teaching, of characteristics of teacher-pupil interactions, and of the effects, both positive and negative, of teacher beliefs and attitudes upon pupils. It should prove useful to teachers, student teachers, administrators, and parents as a source of reflection about their practices and about what can be done to improve them.

Searching: Partners in Innovation

IDRC 1986.

The annual review of IDRC activities highlights the research and training funded by IDRC in 1986. This year it also includes a special section entitled "External Support for Research" which examines Third World research, particularly the contribution of international development assistance. That section borrows heavily from a report written for IDRC by Prof. John P. Lewis, former Chairman of the Development Assistance Committee of the Organisation for Eco-

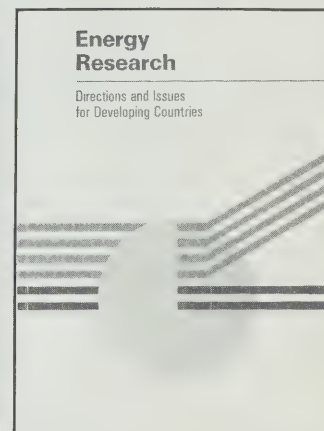
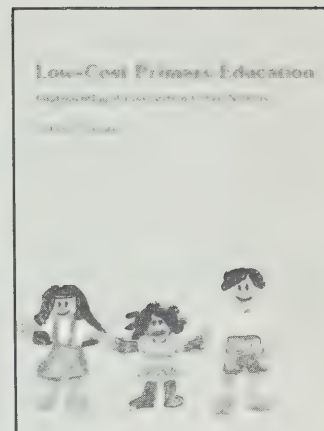
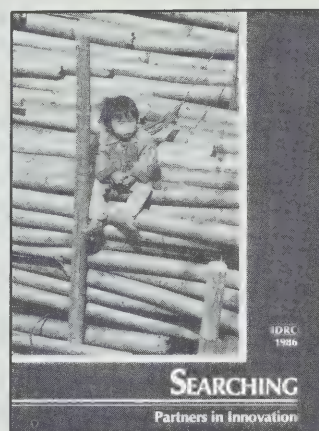
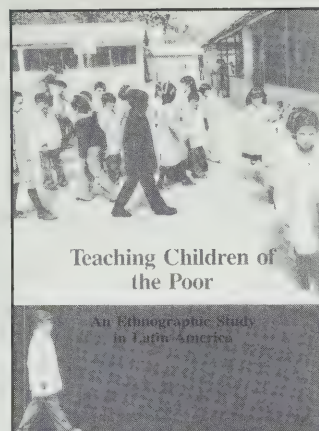
nomie Cooperation and Development (1979-1981). His investigations indicate that R&D expenditures in the industrialized OECD countries total CA\$245 billion annually, as compared with only \$16 billion in the developing countries (which account for 81 percent of world population). Worldwide aid to development-related research is an estimated \$2.1 billion annually. Canada's contribution to Third World research was \$151 million in 1984.

Low-Cost Primary Education: Implementing An Innovation In Six Nations

William K. Cummings.
IDRC-252e. 126 pp.

During recent years in several developing countries, the cost of education has increased while average academic performance of pupils has often declined. IMPACT (Instructional Management by Parents, Community, and Teachers) was developed by a group of educators in Southeast Asia to reverse these trends. They proposed to replace conventional educational components with programmed instruction and learning, student and community volunteers, and instructional supervisors. First launched in the Philippines and Indonesia, aspects of the new concept were subsequently introduced in Malaysia, Jamaica, Liberia, and Bangladesh.

The book examines the history of the concept in these settings. Lessons are identified that should be of interest to several groups: educational planners seeking ways to reduce unit costs while enhancing educational quality; researchers involved in de-



veloping and evaluating new education delivery systems; educational administrators seeking to implement new programs; and donors committed to the support of educational change.

Energy Research: Directions and Issues for Developing Countries

The Energy Research Group: Ashok V. Desai, Djibril Fall, José Goldemberg, José Fernando Isaza, Ali Kellani, Ho Tak Kim, Mohan Munasinghe, Frederick Owino, Amulya Reddy, Carlos E. Suárez, Zhu Yajie. IDRC-250e. 184 pp.

The final report of the Energy Research Group surveys energy research and suggests priorities for developing countries. The report is based on three premises: energy research must be related to research on the

entire economy and society; energy sources must be studied in the context of demand for them; and energy saving is as important as energy production.

The report begins by examining the environment for research in developing countries and the role played by governments, research institutions, producers, and international funding agencies. Various approaches to energy demand management and conservation are outlined and illustrated.

The Group goes on to pinpoint research priorities for various energy sources—liquid, gaseous, and solid—as well as thermal energy, motive power, and electricity. Of the many pervasive environmental effects of energy production and use, the report focuses most closely on three: deforestation and desertification; the greenhouse effect; and acid rain. The general conclusions of the report are summarized in three final chapters. □

In addition to IDRC *Reports*, the Centre publishes a wide range of material on development issues. These include scientific monographs, reports, and bibliographies on specific IDRC research areas, as well as general interest literature. These publications represent research interests and activities supported by IDRC in agriculture, food and nutrition, population, health, education, information, and social sciences. Films describing the Centre and some of the areas of development research are also available. A catalogue of current material, publications or films, is available from the nearest IDRC regional office or from IDRC in Ottawa (see page 3 for complete addresses.)

Publications may be ordered from the IDRC sales agents listed here.

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VOLUME 16, NUMBER 3 — JULY 1987

THE
IDRC

reports



Balancing
the economic
burden



Treated timber for low-cost housing

On reading the articles on Third World housing in your January 1987 edition, I was interested to read about the difficulties in obtaining raw materials for building in these countries.

The use of wood as a construction material was touched upon, but only with reference to durability problems in Uganda, presumably a reference to termites. In many Third World countries, wood is, of course, a scarce material and in great demand as a fuel. However, in Uganda, Tanzania, Kenya, and Ethiopia considerable areas have been planted with timbers such as Radiata pine and various Eucalypts. Given effective preservative treatment by vacuum-pressure impregnation in specialized plants, these timbers can be given service lives many times that of untreated timber. Such preservation facilities do exist in the above-mentioned countries and could be expanded at moderate cost.

Malaysia is an example of a country with an extensive low-cost housing program mainly based on the use of timber treated with preservatives of the copper-chrome-arsenic type. Complete houses can be built of treated timber, right down to the foundations.

N.V. Cheales
Rentokil Ltd
Timber Preserving
& Products Division
West Sussex, UK

More than condoms needed to halt spread of AIDS

I appreciated reading the excellent article on AIDS in the January 1987 issue of *IDRC Reports*, but believe there are two crucial points that were not mentioned. The points are revealed in the disturbing book *The AIDS Cover-up? The Real and Alarming Facts About AIDS*, by Gene Antonio (Ignatius Press, 1986).

On page 108 of the book is the following statement by Dr Richard Restak, a prominent Washington neurologist who has been studying AIDS as a brain-related disease: "At this point live AIDS virus has been

isolated from blood, semen, serum, saliva, urine and now tears. If the virus exists in these fluids, the better part of wisdom dictates that we assume the possibility that it can also be transmitted by these routes."

The second point, on page 110, is just as alarming: "The September 28, 1985, issue of the British medical journal *Lancet* contained a study by a team of French researchers from the viral oncology unit at the Pasteur Institute revealing that the AIDS lentivirus can remain infectious outside the body for up to ten days." (This was at room temperature in both dry form and liquid medium.)

In light of these facts, are public health officials justified in creating the impression that the use of condoms alone will help to stop the spread of AIDS? Is that not creating a false sense of security among the general public? Perhaps in the long run the practices of sexual abstinence, and monogamy (sexual commitment to one partner) will prove to be the most effective ways to curtail the spread of this terrible affliction.

Rev. Terry Orchard
Ottawa, Canada

The causes of forest destruction

In regard to the Vol. 16, No. 1 (January 1987) issue, we would like to comment on a page 27 brief entitled "Ecology of Wood Consumption". The article states: "The Third World has 60 percent of the world's wood supply, but consumes only 12 percent of its production." The article then goes on to state that developing countries are suffering from the effects of deforestation, and the reader is left to assume that it is developed nations that are responsible.

Statistics in the recently released "Tropical Forestry Action Plan" of the UN Food and Agriculture Organization tell a different story: "Of the 1400 million cubic metres of wood taken annually from tropical forests little more than 200 million cubic metres is used for purposes other than fuel."

Though I am not one to absolve developed countries from the problems which exist in developing countries, we must understand the causes of the present problems if we are to find solutions. The main causes of the destruction of tropical forests are overpopulation and continued high annual population increases, combined with traditional slash and burn agricultural methods, and dependence on wood for fuel in developing countries. Tropical forest management must recognize the development needs of the indigenous population first, if conservation of this resource is to become a reality.

At this time we also want to express our appreciation of the authoritative and very readable *IDRC Reports*. Since our recent introduction to the magazine, each issue has contained articles that have prompted us to read from cover to cover. We look forward to forthcoming issues, and perhaps one day contributing!

Brent Tegler and Ellen Woodley
Campbellville, Ontario
Canada

In praise of local-language books

The commentary entitled "Books, knowledge and informatics" in the January issue contained the following statement: "...they themselves (developing countries) have found translation to be a 'no go' solution in some cases and they are beginning to invest more time in writing or acquiring original manuscripts for production." A whole-hearted "Amen" came to my mind as I iden-

tified with Dr Gopinathan. Local authors are the critical link in the transfer of helpful information to indigenous populations.

Your publication is of interest to us (an NGO) in Mali. Our work is linguistic research and literacy in the national languages. Much of our post-literacy material is centred on various development themes. Your publication is a good source of relevant information.

Bruce Wilkinson
Société internationale de linguistique
Bamako, Mali

Your feedback is appreciated

The staff of Reports welcomes letters of comment and information from readers. Perhaps you're engaged in development work related to the projects described in the magazine. If so, other readers may be interested in what you have to say. Or if you wish to take issue with an article or clarify certain points, drop us a line. Letters, which should not exceed 250 words, are normally edited. Write to:

The Editors
IDRC Reports
P.O. Box 8500
Ottawa, Canada
K1G 3H9

Reports

THE IDRC

Cover photo: Guatemalan woman at the market. The bottom line of all macroeconomic policy is how it touches people's daily lives. See articles pages 4-12, 24-25.

Photo: J. Rojas



IDRC

The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in five sectors: agriculture, food, and nutrition sciences; health sciences; information sciences; social sciences; and communications. IDRC is financed solely by the Parliament of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are located at 250 Albert Street, Ottawa, Canada (P.O. Box 8500, Ottawa, Canada K1G 3H9). Regional offices are located in East Africa (P.O. Box 62084, Nairobi, Kenya); West Africa (B.P. 11007, C.D. Annexe, Dakar, Sénégal); Asia (Tanglin P.O. Box 101, Singapore 9124, Republic of Singapore); South Asia (11 Jorbagh, New Delhi 110003, India); Latin America (Apartado Aéreo 53016, Bogotá D.E., Colombia); and the Middle East (P.O. Box 14, Orman, Giza, Cairo, Egypt).

The IDRC Reports

The IDRC Reports and its companion editions in French and Spanish — *Le CRDI Explore* and *El CIID Informa* — are published quarterly by the International Development Research Centre. Their aim is to keep readers informed of the activities of IDRC and to present articles on subjects related to the Centre's fields of interest. An Arabic version *بحوث للتنمية* is published annually. Copies are available on request from the Communications Division, IDRC. *Editor-in-Chief*: Jean-Marc Fleury. *Associate Editors*: Gerry Toomey (English edition), Robert Charbonneau (French edition). *Spanish edition*: Stella de Feferbaum.

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CONTENTS

Letters

2

OUR THEME THIS ISSUE: MACROECONOMICS

South America's homegrown macroeconomics

4

Through good times and bad, IDRC has kept up its support for a number of gifted and now influential economists. *By Jeffrey C. Fine.*

Nipped in the bud

6

When it came time to introduce the Cruzado Plan's tougher measures, the Brazilian government dawdled — with disastrous results. *By Douglas Janoff.*

Adjusting to protectionism

8

Asia's clothing industry copes with North American trade barriers. *By Rhoda Metcalfe.*

Striking a better deal

9

Some countries fare better than others at the debt bargaining table. A better system is needed. *By David Glover.*

Charting an emerging economy

10

Tanzania's recovering economy is being put under the microscope with Canadian help. *By Andrea Przymowski.*

Turkey's painful success

12

Changing the rules of the economic game can be costly. *By Robert Charbonneau.*

From the garbage dump to hell

13

Picking through the discards of the more affluent is an occupation of last resort for some Filipinos. *By Denis Marchand.*

Cairo's street vendors

14

Squatter markets help to feed the population despite city regulations banning them. *A photo essay by Stephen Homer.*

Deadly dengue

16

The story of Cuba's mass campaign to fight an outbreak of a deadly form of dengue fever. *By Wilson Ruiz.*

The 'planned' families of Tunisia

18

The birthrate has dropped appreciably in the past 20 years, but Tunisians still think four children per family is ideal. *By Mouldi Habchi.*

Teaching the teachers

19

The Aga Khan Foundation is helping Pakistan to produce better schoolteachers for its isolated northern communities. *By Josephine MacFadden.*

Tubers on a thousand hills

20

Better varieties of sweet potato and cassava may help to revitalize Rwanda's small-farm sector. *By Sylvie Bélanger.*

Microfilm is forever

21

Archival microfilm can be stored inexpensively in aluminum foil pouches. *By Gerry Toomey.*

Healers new and old

22

Putting the resources of traditional and modern medicine to the best use in Haiti. *By Robert Landry.*

Oil for Egypt's kitchens

23

Egypt wants to be self-sufficient in vegetable oil by the year 2000. *By Robert Charbonneau.*

Commentary

24

Sub-Saharan Africa is bleeding. The flow of debt-servicing funds out of Africa must be reversed now. *By Morris Miller.*

Briefs

26

News and trends in international development.

New releases from IDRC

27

SOUTH AMERICA'S HOMEGROWN MACROECONOMICS

Photo: Neill McKee / IDRC



by JEFFREY C. FINE

Most of us can readily visualize and appreciate the benefits of a new handpump, an improved crop variety, or better methods of cultivation. It is much harder to marshall the same enthusiasm for a list of simultaneous equations, a paper bursting with diagrams, and pages of computer printout.

We are aware of course that macroeconomics does touch our daily lives through the prices of the things we buy and sell, the incomes we earn, our prospects for employment, and our mortgage and rent payments. Still, it is difficult to link intellectual abstractions directly to our personal well-being. Indeed, given the serious predicament of many countries, such connections seem to elude economists themselves.

Yet, IDRC's support for research in macroeconomics continues to affect the lives of millions of South Americans. Its influence is beginning to be felt in Africa and is gradually penetrating the International Monetary Fund (IMF) and the World Bank, which so often influence policymaking in developing countries.

The story of this research is fascinating. It is the story of brilliant scholars, of frustrations, failures, and successes, of conflict and collaboration, and of persistence, personal courage, and intellectual growth.

Haven from repression

IDRC's involvement began in earnest with a major multi-year grant to CIEPLAN, the Corporation for Economic Research and Planning in Santiago, Chile. After 1973, under the leader-

ship of Dr Alejandro Foxley, CIEPLAN provided an intellectual haven to a number of economists, historians, and social scientists who were determined to continue their research in the face of growing repression and personal intimidation. Aside from macroeconomics, CIEPLAN operates three major programs in international economics, social policies, and representative institutions. Virtually all of the external support for macroeconomics has come from IDRC.

Over the years, through a combination of intellectual brilliance and painstaking attention to detail, CIEPLAN has grown in stature. Today it is recognized as one of the leading centres for economic research on the continent and has played a meaningful role in economic debate in Chile.

Early on, CIEPLAN economists challenged the Chilean government's claims of economic success. CIEPLAN's figures, based on many hours of careful research into official statistics, told a very different story. Today most Chilean government agencies prefer to use CIEPLAN's version of the national accounts rather than their own.

The economists at CIEPLAN had warned that the boom of the early 1980s, fueled by external borrowings and in disregard of disequilibria in the economy, could not be sustained. The "monetarist" experiment led by the so-called Chicago Boys, was brought to a close with the collapse of the domestic financial system, a crisis in the balance of payments, and a burgeoning external debt. In its wake followed a major drop in living standards, unemployment for over a quarter of the labour force, and considerable suffering for many.

CIEPLAN's proposals for rejuvenating the economy are now studied with considerable respect, even by its opponents. Its comparative research on the South American countries is followed closely.

Centrepiece of Austral Plan

Across the Andes in Argentina, IDRC began supporting macroeconomic research about the time of the "Malvinas" or "Falklands War". It gave a modest grant to CEDES, the Centre for Studies on the State and Society, in Buenos Aires, to conduct research on domestic financial markets, a topic that seemed far removed from the preoccupations of Argentinians at the time.

For IDRC it was risky to finance highly theoretical work on such a seemingly esoteric topic. Yet less than three years later, this research emerged as the centrepiece of a highly controversial attempt, termed the Austral Plan, to arrest hyperinflation and revive public confidence in the newly restored democracy.

One of these Argentine researchers, Adolfo Canitrot, is now a senior government official charged with restructuring the financial system he had previously been investigating. Another, Roberto Frenkel, still heads the research while acting as the principal advisor to the minister of the economy, himself a former IDRC grantee.

The immediate problems of Argentina are far from resolved. Ongoing research now has a new dimension, since researchers are able to contrast the actual outcome of policies with the predictions of their models. The theoretical work continues with exciting prospects for economic policymaking and future research in economics.

In Brazil, about the same time, IDRC offered a small grant to a group of economists in the department of economics of the Catholic University of Rio de Janeiro (PUC). In contrast to CEDES and CIEPLAN, their work has centred about the formulation of a small macroeconomic policy model (see article, p. 6), with some additional work on the financial sector.

Whereas CIEPLAN began with individual sector studies and has steadily moved toward an overall model, PUC started at the other end, so to speak, with a model that was intended to incorporate the separate studies of individual researchers. This difference in approach underscores the need for donor agencies such as IDRC to be flexible in the way they respond



Sign of the times? Lining up in Buenos Aires not to make bank deposits but to buy lottery tickets.

to different institutional or academic needs.

As in Argentina, the researchers at PUC played a major role in devising a plan to slash hyperinflation and stabilize a volatile economy. One of the researchers, Edmar Bacha, became the principal advisor to the planning minister, and other members of the group were forced to cut back on teaching and research to attend various meetings and working parties in Brasilia.

Unlike the Austral Plan, Brazil's Cruzado Plan ran into serious difficulties and was effectively abandoned in late 1986. Today, most of the PUC economists are determined to understand what went wrong and how to extricate the economy from its current predicament. Undoubtedly their knowledge and skills will be called upon in the difficult period ahead.

IDRC support for research in Peru commenced with grants to two promising young Peruvian economists to complete their doctoral theses at Oxford and Yale. Both Carlos Paredes' work on how inflationary forces are transmitted through the economy and Alfredo Thorne's research into saving and investment have attracted queries from as far afield as East Africa. Economists there believe there is much to learn from another semi-industrialized economy with similar features.

Since returning to Peru, Paredes and Thorne have continued their research at the Group for Economic Analysis (GRADE). Under the direction of a former IDRC researcher, Francisco Sagasti, GRADE is quickly establishing a reputation for serious, high-quality research into public policy. The researchers' skills will be needed as Peru juggles the problems of maintaining economic growth, creating employ-

ment, servicing a crippling external debt, and keeping inflation under control.

In 1985, the newly elected President, Alan Garcia, introduced a series of emergency measures, the Inti Plan. Its principal features, designed to reduce inflation, resembled those of Brazil's Cruzado and Argentina's Austral plans.

In a significant departure from those two plans, however, President Garcia also announced that payments on the external debt would in future be limited to 10 percent of annual export earnings. Although actually an improvement on the previous government's performance, the pronouncement effectively shut down lending from the IMF, most donors, and the commercial banks.

Peru's economy has performed well over the past year. The crunch may come soon, however, as the country consumes its stockpile of imports and exhausts its existing lines of credit. Without imports of essential raw materials, machinery, spare parts, and food, large sections of the economy may eventually grind to a halt.

Colombia's think tank

Researchers at Fedesarrollo, the Foundation for Higher Learning and Development, in Bogota, Colombia, have been spared the dramatic events of the other four countries. The Colombian economy continues to grow at an unspectacular but steady pace, owing in part to sound economic management. Over the years, Fedesarrollo has functioned as an important 'think tank', providing sound advice to policymakers on a variety of useful topics.

With IDRC support, the executive director



BRAZIL'S CRUZADO PLAN

NIPPED IN THE BUD

of Fedesarrollo, Dr José Antonio Ocampo, produced a definitive work on savings and investment in Colombia. The information will help the government to mobilize domestic and foreign resources and deploy them more effectively.

IDRC's involvement with this increasingly influential group of Latin American economists has led to the establishment of a formal network to exchange ideas and publish work of mutual interest. In March 1986, researchers met in Buenos Aires to discuss saving, investment, and financial markets. A joint publication will be released shortly.

In February 1987, an important meeting was held in Bogota to allow researchers to compare the Cruzado, Inti, and Austral Plans, along with the more conventional IMF-type program adopted in Bolivia. This group of gifted economists painstakingly critiqued policies that many of them had helped to design and that drew heavily on their research. The intellectual atmosphere was highly charged as the participants comprehended the potentially far-reaching implications of their work for both theory and policymaking.

Intellectual journey

From IDRC's perspective, the Latin American researchers appear partway along an intellectual journey that could profoundly reshape the way we look at economic behaviour and institutions. One outcome may be profound changes in both economic theory and policymaking.

The intellectual exercise has taken the form of a debate (dating from the 1950s) between the 'neo-structuralists' and the 'monetarists'. In a nutshell, the former believe economic behaviour is shaped by institutional, cultural, and social factors, and that economists should be concerned with the 'real side' of the economy—factors such as investment, output, and employment. The monetarists, on the other hand, stress the importance of money and financial variables and contend that the smooth functioning of market forces is not significantly affected by structural features.

This debate has obvious political overtones since monetarists tend to emphasize the innate limitations of direct government intervention in the economy. Neo-structuralists adopted an opposing stance, arguing that unimpeded market forces would result in economic distortions with undesirable social consequences.

By the mid-1970s, Latin America was rocked by a series of economic shocks. In Chile, an

extreme form of monetarism eventually led to the collapse of the domestic financial system, a severe economic contraction, and a huge external debt. More subdued versions in Argentina and Peru eventually led to similar results.

The relaxation of exchange controls in several countries sparked off a rapid flight of capital. Governments encouraged extensive borrowing overseas to finance imports and generate growth. As fresh supplies of capital dwindled and debt servicing became increasingly onerous, governments continued to borrow heavily in order to sustain domestic economic activity.

The growth in public expenditures steadily outstripped revenues and inflation quickly became hyperinflation. By the mid-1980s, most South American economies were afflicted simultaneously by economic recession and inflation, a combination not foreseen in the textbooks.

Faced with the immediate problem of curbing hyperinflation, neo-structuralists had to address the role of money. Moreover, they could readily see that financial variables did influence the behaviour of households, companies, and governments in ways that ultimately affected the real economy. The challenge, in theoretical terms, was how to incorporate money meaningfully into neo-structuralism.

Some of this work has been spearheaded by Roberto Frenkel of CEDES. In an early theoretical paper, he suggested that inflation led to changes in wealth by affecting the real value of assets. People responded by changing their demand for different types of real and financial assets. This behaviour in turn would affect investment, output, and employment, that is, the real side of the economy.

The merit of Frenkel's approach was confirmed at the meeting in Bogota which looked at the anti-inflation programs in Argentina, Brazil, Peru, and Bolivia. After many hours of heated discussion, the researchers concluded that the outcome of each program appeared to hinge on changes in the distribution of income and assets.

Many important questions remain unanswered, however, and several years of painstaking research still lie ahead. A convincing synthesis of the real and money sides of the economy will have major implications for both economics and policymaking. ■

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Brazil's Cruzado Plan was a valiant attempt to turn around an economy in deep trouble. Initially it succeeded, but the government's failure to implement crucial follow-up measures at the right moment plunged the country back into economic turmoil. IDRC-supported economists helped lay the groundwork for the Cruzado Plan—but also predicted its demise.

by DOUGLAS JANOFF

The Pontificia Universidade Católica (Catholic University, or PUC) on the outskirts of Rio de Janeiro sounds like it would be a conventional institution.

But it's not.

The campus itself, surrounded by green mountains and the full scent of the neighbouring sea, is a tranquil setting. The inner recesses of the department of economics at PUC, however, are far from calm. Secretaries clang away on typewriters, coffee gurgles in the kitchen, and everyone is vying for a telephone line in the crowded office.

Telephone lines are not the only thing in short supply. There are shortages of many things in Brazil today. One week it's salt. The next week it may be rubber tires. The people outside the quiet university have had to learn to cope with a recent set of food shortages, inflation, and general economic uneasiness. Inside the office, people are working on answers to the economic malaise.

"Yes, the Cruzado Plan is ruined," says economics professor Eduardo Modiano, referring to the economic package that he and his department helped to produce. "But Brazil is not ruined."

Dr Modiano, together with the departmental chairman, Dionysio Dias Carneiro, and colleague Francisco Lopes, has played a crucial role in developing macroeconomic models of the Brazilian economy and using them to simulate various economic activities. In the early 1980s, when IDRC first funded research in their department, their influence was limited, but controversial. They organized seminars, invited the ministers of planning and finance, and gave the military regime their views on the economy—especially on such touchy subjects

as disinflation, balance of payments, and alternative wage policies.

"The first time we had a strong impact was in 1981," Mr Carneiro recalls. "Modiano was the first economist to forecast a negative growth rate. Naturally his view was immediately dismissed."

Two-year recession

Sure enough, 1981 saw the first year of negative growth in Gross Domestic Product in Brazil's history. The country slid into a two-year recession. Only after a maxi-devaluation of the currency was the country able to make a comeback. The government had the courage to go through with it thanks to a favorable forecast developed at PUC.

The medium-term annual macroeconomic model—providing two- to five-year forecasts—used 100 variables designed to examine the consistency of domestic and external policies on inflation, rate of growth, and balance of payments. The researchers concluded that the maxi-devaluation, adopted in February 1983, would double inflation but improve the balance of payments. In fact, inflation did go from 100 to 200 percent in 1983, and the balance of payments increased. Exports rose 20 percent while imports fell 20 percent.

In the same study, the PUC economists had declared that import restrictions would have a cost in terms of economic growth. They forecasted the GDP would decline 3.7 percent. The actual decrease was 3.3 percent.

By 1984 the researchers realized that they were now working with a highly controlled economy—"a new animal" as Mr Carneiro describes it. But this new animal was not responding well to policies which attempted to control demand.

The PUC economists decided that a thorough restructuring of the economy was needed. Research indicated that inflation was taking on a life of its own. The shocks caused by the abrupt rise in prices were the major determinants of the future behaviour of the rates of inflation.

The research undertaken by PUC's economics department from 1982 to 1985 was the empirical and theoretical groundwork used for a radical change: the Cruzado Plan. Six months before the Plan was introduced on February 28, 1986, PUC's economists were ready.

"We were able to test the wage inversion formula, the price freeze, and all the financial indexation of the economy," says Mr Carneiro. "It was the result of the macroeconomic model-

ling we'd worked so hard to produce."

The professors involved in the research, according to Dr Modiano, spent at least half their time in the second half of 1985 discussing the Cruzado Plan with the government. "It's true," he says. "Some of the most important theoretical results of the Cruzado Plan were stimulated by our empirical work."

Just as they had observed in their models, they observed in practice that the more frequently you adjusted wages—for example, every three months instead of every six months—the greater the inflation. The theory of 'inflation inertia', the idea that the rate of inflation was simply influenced by previous rates, was also confirmed.

Initial success

In four short months, the Cruzado Plan was hailed a success. By June 1986, the monthly inflation dropped from 15 percent to 1 percent. There was an economic boom. The balance of payments was held in check, real wages increased, and there was a trade surplus. Most importantly, the previously shaky government regained political support and control.

"The government was so fascinated with the short-term results," says Mr Carneiro wistfully, "that they didn't want to do any of the unpleasant things. They were intoxicated with success." The unpleasant things included price correction, the implementation of a withholding tax system, and the cutting of government expenditures. Dr Modiano points out that the decision to delay was directly linked to the upcoming national elections in November.

"Once again we were first in our prediction of the fate of the Cruzado Plan," Mr Carneiro asserts somewhat proudly but with a touch of remorse. "At the end of September 1986 we declared that if economic measures were not adopted in 1986, we would go through another recession."

One week after the election victory the government introduced Cruzado II—the emergency remedy containing the "unpleasant things". But it was already too late.

Photo: Soraya Venegas



Peddling black market dish soap in front of a Copacabana supermarket that is out of such supplies.

Cruzado II was a bitter pill for the electorate to swallow. Riots and food shortages quickly followed the seven-month spending spree that had temporarily given lower-income Brazilians access to a wide variety of consumer goods.

"As soon as Cruzado II was announced, our department said the Cruzado Plan was doomed," says Dr Modiano. "All that's left of the Cruzado Plan is the name of the currency," he adds glumly.

The professors are highly critical of the way the new measures have been adopted by the government, especially the advance announcement of price increases and, even worse, possible price increases. Such actions instill panic.

"Our goal was to liberalize the market," says Mr Carneiro. "Now it's completely disorganized. We have to start all over again." The economy is more highly indexed than ever, and with a higher rate of inflation: January 1987, 16.8 percent; February, 14 percent; March, over 10 percent.

Since the inauguration of Cruzado II, all professors who held advisory posts in the government have resigned. Exports have decreased, imports have increased, and foreign exchange reserves have diminished so rapidly that Brazil had to suspend its payment of debt interest in February.

But the professors at PUC insist they are not pessimistic. And they speak enthusiastically about their on-going research and their colleagues' work. With IDRC support, Dr Rogerio Werneck is comparing the saving capacity of the public sector in Brazil with that of the private sector. Dr José Camargo is excited about new research into the relationship between income in formal and informal sectors.

There may be economic upheavals outside the university, but at PUC, says Mr Carneiro, "it's business as usual."

Douglas Janoff is a Canadian journalist currently based in Rio de Janeiro. Last year he received a Young Canadian Researchers Award from IDRC to examine Canada's contribution to Brazil's socioeconomic development

ADJUSTING TO PROTECTIONISM

BARRIERS TO ASIA'S CLOTHING EXPORTS

by RHODA METCALFE

Photo: Frank Green



Some manufacturers upgrade their clothing lines to avoid protectionist restrictions.

As their exports have captured a growing share of markets in the North, developing countries and "newly industrialized countries" in East and Southeast Asia have enjoyed a decade of economic growth. But there is concern among these countries that the increasing use of trade barriers by the Northern industrialized countries, particularly their biggest customer, the United States, may threaten the future of their fledgling industries.

One of the most obvious examples of developed country protectionism is in the clothing industry.

Because the industry has traditionally used low-skill labour, poorer countries with low wage levels can produce clothing more cheaply than industrialized countries. Indeed, the latter have become major consumers of these inexpensive imports. In 1984, for example, more than one-third of all garments on the Canadian market came from the Third World, particularly East and Southeast Asia.

For over 20 years, the United States and Canada, among other industrialized countries, have tried to protect their domestic clothing industries from competition from "low-cost countries". Since 1974, the Multi-Fiber Arrangement (MFA) has served this purpose.

Under the MFA, the clothing industry is sliced into narrow categories. Each importing and exporting country set the maximum number of items within each category that the exporter is allowed to supply to the importer.

These quotas have had the most direct effect on the "big four" clothing exporters—Hong

Kong, South Korea, Taiwan, and the People's Republic of China. They have also had mixed effects on smaller Southeast Asian countries, according to a recent IDRC-supported research project.

The study allowed 20 researchers, three from Canada and 17 from East and Southeast Asia, to analyze the impact of North American protectionism on industries in nine countries—Hong Kong, South Korea, Singapore, Malaysia, Indonesia, Thailand, the Philippines, and Canada and the United States themselves.

The project sprang from a workshop on trade and protectionism held in Singapore in June 1984. The main participants in the workshop—Canada's North-South Institute (NSI) and Singapore's Institute of Southeast Asian Studies (ISEAS)—bemoaned the lack of up-to-date information on the reaction of specific industries and countries to protectionism.

The study, coordinated by the two institutes, focused on three industries: clothing, consumer electronics, and vegetable oils. The researchers found that, of the three, protectionism has most affected the clothing industry in East and Southeast Asia.

In reaction to quotas, the big clothing exporters, Hong Kong and South Korea, have "upgraded" their clothing lines, according to project researcher Dr Jaleel Ahmad, who is also a professor of economics at Concordia University in Montreal. They have shifted out of inexpensive clothing categories, such as mass-produced shirts which face heavy restrictions, into less protected, higher-value categories such as designer sweaters.

Ironically, the researchers found that quotas gave smaller, less industrialized countries in Southeast Asia "a leg up in the industry", says Doug Williams, NSI research officer for the project. With the larger producers restricted to set quotas and moving into higher-value categories, smaller producers have filled the leftover demand for lower-value imports. Indonesia, for example, began exporting clothes, mainly inexpensive lines aimed at low-income groups, to the United States in 1980.

Although the MFA appears to have encouraged clothing industry start-ups in the poorer Southeast Asian countries, quota restrictions are likely to stunt their growth, says Mr Williams. Canada and the United States have argued that they already face more competition than they can cope with, he explains. Smaller producers who recently entered the clothing industry are therefore assigned low quotas. "Late starters are cut off before they really get started."

The study points out that big clothing producers, like South Korea, have been slow to shift out of the low-technology garment industry into more advanced industries because quotas give them a guaranteed piece of the North American market. Without the quota incentive, South Korea would probably phase out its clothing production more quickly, according to Mr Williams. That would leave the market open to less industrialized countries.

The study found that North American protectionism is much less extensive in the consumer electronics industry (which includes the manufacture of radio and stereo equipment, television sets, watches, and calculators). Only colour television imports have captured enough of the North American market to provoke strong protectionist measures, according to the project research paper by Harvard University's Glenn Jenkins.

Of those countries included in the study, only South Korea's colour TV industry has been significantly affected by North American trade barriers, specifically quotas in the U.S. and higher tariffs in Canada.

In the case of the vegetable oil industry, the third industry covered by the study, the researchers found that protectionism was not a major problem.

The study results will be widely circulated to academics and government officials in developing and developed countries alike. The hope is, says Mr Williams, that it will help policymakers to understand how protectionism has affected their industries and guide their future decisions on industrial development. ■

Rhoda Metcalfe is a freelance writer based in Ottawa.

STRIKING A BETTER DEAL FOR THE DEBTOR COUNTRIES

by DAVID GLOVER

The Latin American debt problem reached its first crisis five years ago when, in the summer of 1982, Mexico was suddenly unable to meet its scheduled debt payments. Since then, one country after another has rescheduled its debt, essentially taking on new loans to cover payments on old ones.

It is widely recognized that this approach serves only to postpone a generalized crisis; it does not provide a solution. In spite of tough austerity programs and serious efforts to restructure their economies, few developing countries can keep up with their interest payments. The principal on most loans will probably never be touched.

Since the inadequacy of current approaches is widely recognized, it is not clear why other approaches have not been tried. Why have lenders not agreed to write off a portion of the debt or to deal with groups of countries, rather than insisting on case-by-case, country-by-country renegotiations? If case-by-case negotiations are supposed to apply the same rules to each country, why have some countries in fact received better deals than others? Most puzzling of all, why have debtor countries accepted the rules of the game and not formed a "debtor cartel"?

Government officials and university researchers in seven Latin American countries are attempting, with IDRC support, to answer some of these questions. Led by Chilean economist Dr Stephany Griffith-Jones, they are comparing their countries' experiences in bargaining with commercial banks, creditor governments, and multilateral institutions. The researchers believe that in order to promote new solutions to the debt problem, one must first understand why the current system of case-by-case negotiations persists. By looking at the principles followed in each round of bargaining and the results achieved, they also hope to find ways to make the negotiating process less costly and more equitable.

Payments linked to earnings

The November 1986 negotiations between Mexico and the International Monetary Fund (IMF), for example, established a number of new principles, now being used as precedents in other rounds of bargaining. First, by relating payments to earnings from oil exports, Mexico's main source of foreign exchange, the agreement linked the country's obligations to its ability to pay. It also recognized that growth was a legitimate objective, without which future repayment would not be possible.

An examination of the Mexican deal also re-

vealed one more bargaining tool that debtor countries can apply. Mexico threatened to pay its debt only in pesos. In practice, this action is not much different than defaulting, but banking legislation usually treats it as less serious. It is therefore somewhat less threatening to the banks.

When the only threat debtors have is to declare a moratorium and cut themselves off from the world system, the threat is not likely to be credible. Debtors are likely to do better in negotiations when they can bargain with a variety of smaller but escalating threats.

The negotiating process is particularly crucial to small countries such as Costa Rica. Not only do small countries receive tougher conditions from commercial banks, they are also least able to spare the human resources required to negotiate and implement agreements.

With so many loans outstanding to a variety of creditors, Costa Rica's civil servants spend much of their time moving from one set of negotiations to another or implementing previous agreements, rather than dealing with domestic problems. The financial costs of each negotiation are also high and are borne entirely by the debtor.

"Grid-lock" syndrome

Many banks agree to make new loans only if the country agrees to conditions set by the other lenders, particularly the IMF. This "cross conditionality" makes implementation particularly difficult since default on one agreement, even if minor or temporary, will nullify a whole string of other agreements. Many of these agreements require changes in legislation or changes in the practices of several government agencies, each in a specific order. The effect of the ensemble of negotiations is to turn the entire economy into a kind of "grid-lock" of cross-conditional and occasionally contradictory measures.

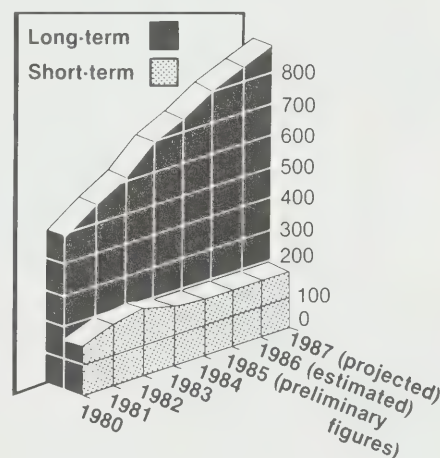
Small countries with little bargaining power and a limited number of trained negotiators find this situation particularly onerous. Costa Rica has suggested that, since even a complete default on its debt would have little or no effect on the world financial system, there would be little risk for creditors in experimenting with some innovative and simplified negotiating practices.

The researchers have also noticed that coordination among creditors is far more developed than among debtors. So many commercial banks are usually involved on the creditor side that it would be impossible to include them all in negotiations. Instead, they have set up steering committees of bank representatives.

On the debtor side, the major problem seems

to be the rotating nature of the crisis. In October 1986, for example, when Mexico was forced to the negotiating table, Brazil was doing well and had no need to deal with the IMF. Similarly, when Peru announced its debt service ceiling whereby it limited debt payments to 10 percent of its export earnings, Argentina was doing well and was uninterested in joining a common front.

**Developing
Country Debt**
(US \$ billions)



Note: The data reflect the rescheduling of about \$45 billion of short-term debt to banks into long-term debt in 1983-86.

Source: IMF Survey, Vol. 16, No. 6, March 23, 1987

Ironically, both creditors and debtors agree on the need for a more fundamental solution. Creditors agree that there must be increased net capital flows to debtors even though the objective of each individual bank is to reduce its own exposure. Debtors agree that someone must take a strong stand against the creditors but each believes someone else should go first.

At the moment, there are few signs that this logjam will break.

David Glover is Associate Director, Economics, in IDRC's Social Sciences Division.

CHARTING AN EMERGING

To chart a rational course in the coming years, the leaders of Tanzania need to better understand the nuts and bolts of their developing economy. A team of Tanzanian economists, working with Canadian colleagues, is now studying the national economy in depth to provide some of the needed insights.

by ANDREA PRAZMOWSKI

The driver attempted to nose the car into the standstill traffic clogging Samora Avenue in central Dar es Salaam, Tanzania. Five minutes later the vehicle was only a few metres along the cracked pavement.

"A year ago there was no such thing as a traffic jam in Dar," remarked one of the passengers. "Gas was so expensive few people could afford to drive."

While traffic jams may be a new phenomenon in this East African country, Tanzanians are no strangers to 'lack of forward motion'. In 1986 the country was only slowly emerging from the depths of a six-year crisis that had forced the economy to a standstill and then sent it into reverse. The crisis was reflected in steadily declining real incomes, acute shortages of basic consumer goods, and high unemployment. Each year from 1976 to 1984 the Gross Domestic Product (GDP) dropped, and inflation rose between 11 and 36 percent. The balance of payments deficit soared as foreign exchange became scarce and domestic industrial output dropped to less than a third of capacity.

Numerous causes for the dizzying descent of the economy have been cited, including the 1979-80 escalation of world oil prices, collapse of export commodity prices, high interest rates, a series of droughts, Tanzania's dependence on a few export crops, and the burden of the war with Uganda. Critics also blame inappropriate domestic policies such as pricing disincentives to farmers, increasing regulation of consumer prices, and the Ujamaa (socialist) villagization program of the early 1970s.

Since the government embarked upon a three-year Economic Recovery Program (ERP) in 1986, the economy has been picking up speed. The greatest acceleration has been in the flow of foreign capital following the signing of a long-debated agreement with the International Monetary Fund (IMF) in September 1986. That opened the gates for agreements with other donors worth a total of US\$800 million per year in loans and grants, plus a rescheduling of the foreign debt and support for ERP.

Now, under President Ali Hassan Mwinyi, Tanzania is undergoing a major transition as it attempts to rebuild its economy and meet the conditions of the international loans.

The Tanzanian shilling has been substantially

devalued—from 17.5 shillings to the U.S. dollar in June 1986 to 56 to the dollar in April 1987. Meanwhile, the black market rate has dropped to 140 shillings to the dollar from a June 1986 figure of 180 to the dollar. The IMF agreement calls for further devaluation, until parity is reached.

Producer prices for export crops have been increased and the 1986 production of three main export crops—coffee, cotton, and cloves—showed encouraging increases. Major consumer price increases were applied to items such as clothing and textiles. An import liberalization policy has made luxury items widely available in major cities, in stark contrast to the empty shelves which symbolized the economic crisis. Trends show the government's target of 4 percent growth for 1987 is likely to be met.

Economic modelling

While the ERP and the IMF agreement seem to have set the economy in motion again, many critics are asking to what degree these measures compromise the basic principles of Tanzanian socialism—equality, participation, and self-reliance—that have guided the nation for the past two decades. For example, how will higher consumer prices affect the quality of life of the poorest sectors of Tanzanian society? Such questions, of course, cannot be answered in a vacuum. What is needed is reliable information on the mechanics of the national economy, as well as a framework or model for predicting the impact of economic policy options.

In the University of Dar es Salaam's economics department, an IDRC-supported team of researchers is now working on such a model. In effect, it is charting a map of the Tanzanian economy, with the hope of making it easier for the government to navigate whichever economic path it chooses. The work, begun in 1983 and headed by Drs Benno Ndulu and Nguyuru Lipumba, includes a number of sectoral studies on agriculture, industry, the public sector, the external sector, and savings and investment.

"In any developing economy, things are naturally moving more quickly than in a stabilized economy," says Dr Samuel Wangwe, an industrial economist and Dean of Arts and Social Sciences at the University of Dar es Salaam. "But that's when you especially need

a model—to be able to simulate the outcome of various policy measures."

The project is also designed to develop the expertise of Tanzanian economists and to improve the ability of Tanzanian negotiators to hold their own in discussions with international agencies.

The researchers are being assisted by economists from the University of Toronto, in Canada, headed by Gerald K. Helleiner. About 15 economists, from both universities and the Tanzanian government, are involved. Although similar research has been carried out by individuals, such a large-scale and intensive study of Tanzania's economy has never been attempted.

Dr Idris Rashidi, director of research for the Bank of Tanzania, says he welcomes any research that will help the government depart from its tendency towards "crisis management".

Income distribution is one measure of equality that is used by the government and which the researchers are trying to incorporate into the model. Prior to independence the ratio of highest to lowest income was estimated at 100 to 1. The government now claims the ratio has dropped to 7 to 1 because of its wage regulation policies.

"I can't buy that," says Dr Wangwe. "Income inequality has been under-rated. Many people in the villages are earning below the minimum wage of 1000 Tanzanian shillings (US\$18 in April 1987) per month, but some people who are getting (maximum) salaries of 7000 Tanzanian shillings (US\$125) are also getting fringe benefits such as free housing, free cars, and free servants, bringing their actual salaries up to 40 000 or 50 000 shillings." And, in order to survive on low wages, most people find a way to earn a second income, according to Dr Wangwe. University administrators are not exempt. Dr Wangwe's family raises chickens and pigs, and he also operates a transport service using his own small truck and a hired driver. His net monthly income is 5000 shillings (US\$89), but with his "sideline activities" he estimates his actual income at 20 000 shillings (US\$357).

The "under-rating" of income inequality illustrates one of the first obstacles the researchers faced—a lack of reliable data. In gathering statistics for the sectoral studies they are slowly filling that gap.

The team began its work by formulating a

ECONOMY

preliminary model based upon previous research and available data. With the help of their Toronto counterparts, the group then identified the model's shortcomings and the gaps in data. The model has been readjusted and is being tested, and will continue to be refined as more subtleties are uncovered, explains Dr Wangwe. Throughout the process, the information is being shared with policymakers in the government.

Second economy

A major feature of the Tanzanian economy, one which characterizes its instability and poor performance, is its vigorous unofficial sector known as the "parallel market" or "second economy". Another IDRC-sponsored study group is concentrating on this sector, which researcher Mboya Bagachwa describes as "visibly vibrant".

Before the study group was formed in 1986 the total value of all second economy activity was estimated at 10 percent of GDP. However, the group now puts it closer to 30 percent—"a conservative estimate", according to Mr Bagachwa.

The range of activity outside the official economic structures is vast—from cottage industries such as tailoring and street-corner shoe repair, to land speculation, smuggling, foreign exchange transactions, and the operation of private markets for goods and agricultural products.

Officially, goods production and distribution are regulated by numerous parastatal agencies and crop authorities. The reality is otherwise. For example, the government estimates that 75 percent of all rice and maize produced is sold privately. It is important to have accurate estimates of such second-economy activity. Otherwise, important economic indicators such as GDP, savings, productivity, employment, and inflation are not reliable.

The study of the second economy illustrates the team's belief that valuable information will come from the various sectoral studies, and not only from the end product, the macroeconomic model.

Agriculture is the heart of the economy, so dissecting its problems is a top research priority. This sector accounts for 80 percent of foreign exchange earnings and employment and contributes 40 percent of GDP. With a mere quarter of Tanzania's 16 million hectares of arable land under cultivation, the potential for agricultural growth is immense.

A major policy question involves increasing prices as an incentive to producers. While official records show production did increase after such a move, the question is whether the increase was real or whether higher government prices merely lured producers from the unofficial market where prices had traditionally been

Dr Wangwe, however, says he doubts the IMF agreement will lead to structural changes that will affect the functioning of the model. "It may make certain policy measures more important than others—for example, it may make prices more important than administrative allocation of resources—but it doesn't change the model."

Photo: Andrea Prazmowski



Cheaper oil has spawned traffic jams in Dar. The economy, like the streets, shows signs of renewed life.

higher. This is but one example of the numerous policy issues being studied by the research team in its efforts to better understand the various sectors of Tanzania's economy.

Some observers say major structural changes in the economy will inevitably result from the government's recovery program and the IMF agreement. In fact, Enrique Rueda-Sabater, resident economist with the World Bank in Dar es Salaam, suggests the macromodelling exercise may be premature in light of the present instability of the Tanzanian economy. He says a macromodel is most useful when the job at hand is to "fine tune" an economy, and Tanzania is not yet at that stage.

Nevertheless, the researchers acknowledge the limitations of the model. As Dr Lipumba wrote in a preliminary paper for the project: "We are dealing with a fragile economy that has not established a basic structure whose parameters can be correctly estimated. . . . However, the modelling exercise may improve the understanding of certain key relationships and the estimation of some of the equations may provide a better understanding of the outcome of past policies." ■

Andrea Prazmowski is a freelance writer based in Ottawa.

TURKEY'S PAINFUL SUCCESS

by ROBERT CHARBONNEAU

In 1980 the Turkish government abandoned protectionism and moved to promote exports. Whole sections of the economy fell away to the accompaniment of spectacular bankruptcies. New industries were also born of this readjustment. The turnaround, however, was a painful one.

At a time when the fashion every where else, both East and West, favoured protectionism, Turkey decided instead to liberalize its economy. At that time, with the exception of agricultural products, 42 percent of U.S. products, 30 percent of those of the Common Market, and at least 20 percent of those of Japan were protected.

In Turkey, abolishing protection amounted to a revolution. The country was thrown completely open to imports which immediately

successful adjustment to the sudden changes made by the economists. But the effects of the shock haven't worn themselves out yet. Inflation went as high as 40 percent but it has now fallen back to 25 percent. From US\$2 billion in 1980, exports have soared to \$7.2 billion. The debt never worried the creditors in the past, but it has now reached \$31 billion and there are fears that the worst could happen.

Why did the politicians launch out into such radical changes in the economy?

By the beginning of the 1980s the Turkish economy was collapsing because it couldn't draw in the foreign currency it needed to keep the factories running. For two consecutive years the economy, rather than growing, shrank. The currency was therefore devalued and interest rates were raised to 40 percent. All of a sudden the Turks began to save and cut their con-

sumption. Theoretically they are rich. The truth is that repayment is often slow and the banks are very vulnerable. Many small firms can't live with such a rate of interest. Unemployment has risen to an intolerable level on which it is impossible to put an accurate figure. The general opinion is that it is somewhere between 20 and 30 percent.

All these concerns figure in the thoughts of Mrs Tansu Çiller, an economics professor and researcher at Bogaziçi University. How will the Turkish economy behave in coming years? How can the industrialization of the country be reinforced and its growth stabilized? What about joining the European Common Market? "Why not?" asks Mrs Çiller. "Poor countries like Portugal have benefited greatly from it. Turkey has excellent trade relations with the Middle East and with Europe. Exports already constitute 36 percent of the Gross National Product. Turkey could help Europe to benefit from Eastern markets and serve as a bridge to the Orient. The Turks themselves are much more in favour of entering the Common Market than were the Portuguese or the English."

Mrs Çiller admits that going into Europe will take time. "Europe isn't yet ready to accept the free movement of Turkish workers. And taxation and monetary policies will have to be brought into line before the economies can be linked. All the same, both sides stand to gain from the association."

Turkey already exports its textiles to Europe on a large scale. And agriculture won't find it hard to adjust to Common Market restrictions. "We are called upon to feed the Middle East where the population is growing rapidly," says the researcher. "So far the Middle Eastern markets don't much value our fruit and vegetables, but income in those countries is dropping and the effect may well be to make what we have to offer look more attractive."

Mrs Çiller doesn't deny there are political difficulties, particularly the disagreement with Greece, which as a member of the Common Market might veto Turkish entry. Cyprus still arouses passions and so does sovereignty over the Aegean seabed and its petroleum reserves.

Mrs Çiller's research, undertaken with IDRC's financial assistance, deals with the liberalization of the Turkish economy and the mechanisms required to integrate Turkey into an economic group such as the Common Market. "I am convinced Turkey's long-run chances are good. By the year 2000 maybe."

Whatever the outcome, Turkey's recent request to join the Common Market will certainly surprise the Europeans and make them reflect.

Photos: Robert Charbonneau / IDRC



Istanbul's economic dynamism hides a devastating 30 percent unemployment rate.

endangered a number of sectors of the economy.

The general and virtually instantaneous abolition of quotas and the substantial decrease in customs duties blew away more than 1000 companies a year. Firms which had overborrowed, or which owed their existence to a protected captive market, or whose productivity and technology were too feeble to stand up to competition, went over like ninepins.

Despite those corporate failures, Turkey's rate of growth in 1980 was 7.9 percent, the highest of the 21 member countries of the Organization for Economic Cooperation and Development.

All in all, the Turkish economy made a suc-

cessful adjustment to the sudden changes made by the economists. But the effects of the shock haven't worn themselves out yet. Inflation went as high as 40 percent but it has now fallen back to 25 percent. From US\$2 billion in 1980, exports have soared to \$7.2 billion. The debt never worried the creditors in the past, but it has now reached \$31 billion and there are fears that the worst could happen.

Meanwhile, the unemployed wandered about on the streets, the helpless victims of the abrupt transformation of the economy.

20-30 percent unemployment

Despite its enviable rate of growth, the Turkish economy still has its failures. Savers are afraid. The state of health of the banks is wobbly. Four of them have already closed shop since the start of this year. The banks pay savers 45 percent and charge 85 percent for loans.

FROM THE GARBAGE DUMP TO HELL

by DENIS MARCHAND

Dressed in rags, thin and dirty, dozens of children pick through the pile of garbage in the middle of the immense municipal dump on the island of Cebu, in the Philippine archipelago. With their bare hands or using handcrafted picks, they collect everything that looks as though it can be used or sold.

Each day, they and their parents go through their paces. They feel at home in the garbage dump of Inayawan. It is here that they eat, sleep, play, and, more importantly, work.

This hellish life, which would make most of us shudder, is the lot of a great number of peasants who, leaving the misery of the countryside, converge on the cities, sustained by the hope of finding decent work and an adequate income. But factory jobs are scarce and employment prospects far from bright for those without special skills. Without jobs, their meagre savings disappear quickly. These rural exiles soon find themselves condemned to live by their wits.

To avoid starvation, these families are reduced to picking through the garbage, looking for something that can be resold. Rather than harvesting the fruits of the earth they know so well, they live in uncertainty, gathering the discards of a consumer society.

Pieces of metal, scrap iron, glass, plastic, paper, textiles, animal bones, and scraps of food represent the only hope of survival for these "scavenger" families. The smoke, the foul odours, the vermin crawling all around them, and the ubiquitous germs do not overly concern either the children or the adults. The garbage dump is their home.

Community with its own rules

Among the mountains of refuse, a site has been reserved for the makeshift residences of these "workers". Usually built with pieces of wood, cardboard, or sheet metal, each house barely has room for more than four people, though the average number per family is seven.

If fortune smiles on them at all, the "scavengers" will be able to eat scraps of meat,

fruits, or vegetables recovered from the piles of household garbage. Otherwise, they must settle for dried fish and a little corn. This poor diet, deficient in vitamins and protein, naturally causes major health problems among dump dwellers. Pregnant women in particular suffer from acute anemia, and the infant mortality rate is high.

To avoid the internal bickering that might poison their working environment, the "scavengers" have adopted a strict code. Work is done on an individual or family basis, and tacit agreements determine the rummaging area for each household.

Often, the men work more than 16 hours a day with only a handful of pesos to show for it. The work goes on late into the night, by the light of kerosene lamps lit by men and children over 10 years of age.

The arrival of a garbage truck inevitably triggers excitement. Some people cling to the vehicle, while others hurry to surround the spot where the cargo will be dumped.

"Alas, the future prospects for these people are bleak," affirms Estella Astilla, a professor at San Carlos University in Cebu who, with IDRC funding, has examined the problems of these marginal populations. "The government has never really shown an interest in recycling raw materials, and even less the will to regulate this area," she says. Prisoners of the chronic poverty of their families, the children in particular are threatened by serious social repercussions which may well destroy their prospects for a decent future.

Hired killers and pimps

Indeed, the children live on fertile ground for crime and prostitution. Almost all of the children living in the garbage dump abandon their education once they've completed elementary school in order to pick through the mounds of refuse, beside their father and older brothers and sisters. As they grow up, it is not uncommon for them to join bands of hired killers or to fall into the clutches of pimps who take them as prostitutes to the tourist areas of Manila or near the American military bases.

Many children are recruited or kidnapped in this way, and some end up in foreign countries, knowing no one, with no money or means of defence, slaves of a child labour or prostitution ring. In effect, they leave the garbage dump to enter a world more hellish still ■

Photos: Denis Marchand



Fertile ground for crime and prostitution. For children the options are bleak — scavenging among the garbage or walking the streets of Manila.

Denis Marchand is a Canadian freelance journalist who visited Asia as part of a project of the *Fédération professionnelle des journalistes du Québec*, funded by the Canadian International Development Agency.

CAIRO'S STREET VENDORS: A VITAL LINK

TEXT AND PHOTOS BY STEPHEN HOMER



Every morning Abou El Ezz Mahmoud wakes up at 5 a.m. and travels with his son by train from North Cairo to Zeitun market. He is a vendor of fruits and vegetables, one of more than 7700 vendors who sell everything from live chickens to plastic shoes in a multitude of squatter markets scattered throughout Cairo.

Abou El Ezz is the "sheikh" or leader of this market. He settles misunderstandings, organizes vendors, and deals with government inspectors. More than ever his work is cut out for him because Cairo's squatter markets—unauthorized markets set up on sites designated for other purposes—are under fire from urban authorities.

Recent changes in market legislation have resulted in city officials attempting to regulate and, in some cases, banish squatter markets. Market police complain that vendors with donkey carts compete with cars in the clogged streets. Health hazards are posed by unrefrigerated meats, lack of running water, and piles of garbage.

In response to increasing tension between city officials and vendors, the Social Research Centre of the American University in Cairo, with support from IDRC, undertook a two-year study of Cairo's squatter markets. The results showed that while squatter markets do contribute to the city's crowding and health problems they also provide essential food and services in a way that no established retail enterprise can.

The study also revealed that vendors and hawkers are not at the bottom of the economic ladder. Half of the peddlers earn from US\$1.65 to \$2.68 per day, which is more than the average income of university graduates in the public sector. Most consider vending a satisfying and stable occupation. Many have peddled goods for 10 to 20 years and more than half inherited the trade from their parents.

The study made it clear that in a city of 14 million people, with one of the highest population densities in the world, squatter markets and mobile hawkers will remain a vital link between producers and consumers. It urged that more detailed study be made of the city's squatter markets and that urban planners be sensitive to the needs of people like Abou El Ezz whose lives they are trying to order. ■

Stephen Homer is a freelance writer/photographer based in Montreal, Canada.





CUBA'S CAMPAIGN AGAINST

DEADLY DENGUE

by WILSON RUIZ

On the morning of June 1, 1981, 12-year-old Octavio Veliz was rushed to the Hermanos Almeida Hospital in Havana. His mother told the admissions nurse her son had awakened with fever, nausea, and vomiting. The boy complained of abdominal pains and his face and legs were covered with a rash.

The doctor in charge of the out-patient clinic ordered a series of tests. Five hours later the

nounced that Cuba had been hit by a dengue epidemic.

Of the several clinical syndromes caused by arboviruses (viruses transmitted by insects) the hemorrhagic fevers are among the most feared because of the significant number of deaths they cause. The Cuban medical authorities did not believe that the dengue epidemic affecting their people was the sometimes fatal Dengue Hemorrhagic Fever/Dengue Shock Syndrome (DHF/DSS). But on June 5, Octavio Veliz died

epidemic's victims, doctors applied tourniquets to patients' arms for a short period. Those suffering from DHF experienced a great accentuation of hemorrhaging under the skin, even at points away from the tourniquet. The skin became dark violet in colour. Other evidence included the vomiting of black material similar in appearance to coffee grounds, a drop in body temperature, cold and clammy skin, and conspicuous sweating.

Anti-mosquito brigades

Later in June the medical authorities decided that the epidemic had to be attacked at its source. So three weeks after the first case of dengue was reported, 10 000 volunteers, organized into mini-brigades of two or three people, spread out over the country in an attempt to wipe out the *Aedes aegypti* mosquito. A major breeding ground of the insect was water storage containers used in homes that have no running water. Because the volunteers were operating in their own neighbourhoods, they had no problem gaining access to people's homes to check for mosquitoes.

Through massive public participation and cooperation, the Cubans managed to stop the epidemic and eradicate the *Aedes aegypti* mosquito in six months. During the epidemic 350 000 adults and children were infected with dengue and 116 000 of them were hospitalized. There were 10 000 cases of DHF/DSS, with 158 deaths, 101 of them children. According to Cuban medical experts, it was the all-out public participation that made control of the epidemic possible and offered an excellent opportunity for an in-depth study of the cases of DHF/DSS.

In the aftermath of the 1981 epidemic, IPK researchers in Havana, supported by IDRC, began investigating various characteristics of the virus that caused this outbreak and of the people affected. Led by IPK's director, Prof. Gustavo Kouri, a research team set out to identify possible risk factors related to race, sex, and a history of certain chronic diseases.

In an interview at IPK, Prof. Kouri said his study uncovered several "fascinating puzzles" that centre on the hemorrhagic fevers caused by dengue viruses. He explained that viruses similar to dengue serotypes I and II, which up to now have been recognized as producing only classic dengue, may be capable of producing a fatal hemorrhagic disease. This could occur when someone who has had a previous dengue infection is re-infected with a different serotype within a five-year period.

This theory is consistent with recent outbreaks of dengue in Cuba, specifically an epidemic of dengue serotype I in 1977 and the epidemic of dengue serotype II in 1981.

High-risk groups

The research project also revealed an increased risk of severe DHF/DSS in whites, and females, and in association with certain chronic diseases such as asthma and diabetes. The course of the disease in adults is different from that in children, and the virulence of the virus seems to increase during the course of the epidemic.

The study has been successful not only from a scientific point of view but also because it has helped to upgrade the expertise, skills, and facilities at IPK. However, as often happens, the findings of this study have created even more questions.

In a second phase of IDRC-supported

Photo: Neale MacMillan



Dengue researchers Dr Gustavo Kouri (left) and Dr Maria G. Guzman, both from Havana, with Dr José Esparza of WHO's Division of Communicable Diseases.

diagnosis came back: dengue fever, a viral infection transmitted by the *Aedes aegypti* mosquito.

The hospital notified the Pedro Kouri Institute of Tropical Medicine (IPK) and within hours the well developed Cuban health care system went into action. A public appeal, through radio and TV, advised that anyone suffering from the symptoms observed in Octavio Veliz should immediately report to the nearest hospital or medical centre. Twenty-four hours later, over 1000 adults and children were hospitalized and the Public Health Ministry an-

and the Public Health Ministry declared a national state of emergency.

The civil defence system and the Revolutionary Neighborhood Committees were mobilized. With massive public participation, an anti-dengue campaign went into effect and advanced with the precision of a military operation. Those already infected were isolated in specially selected hospitals. Unfortunately the medical teams were not prepared to deal with the disease since DHF/DSS had never before been seen in the Western Hemisphere.

To diagnose cases of DHF among the

research, IPK is continuing its investigation of the possible risk factors associated with DHF/DSS, and of the characteristics of the virus. Prof. Kouri and his team are trying to determine why some areas of Cuba had more or less severe manifestations of the disease. In each of two selected areas, a sample of about 1200 people will have blood tests to determine whether dengue antibodies are present and will be given questionnaires asking for general information and past health history.

The sophisticated techniques used by the Cuban researchers will furnish information

about the origins of the virus not only in Cuba, but in other Third World countries. This marks a real breakthrough in integrating Cuban research into the activities of other countries in the region.

The results of the research in Cuba and the experience of mobilizing the populace to control the 1981 epidemic will have great importance throughout Central America and the Caribbean. Because at least three of the four dengue serotypes are found in the region, the risk of a DHF/DSS epidemic is ever present.

Some cases have already been reported in

Nicaragua and in Brazil an epidemic of dengue serotype 1 has infected over one million people in Rio de Janeiro and Sao Paulo. "The *Aedes aegypti* mosquito seems to be moving south," warns Prof. Kouri. "We must foster further regional cooperation to prevent the outbreak of another fatal DHF/DSS epidemic." ■

Wilson Ruiz is a Canadian freelance writer specializing in Latin American affairs. He visited Cuba in January 1987.

FEBRUARY 1987:

COMPARING NOTES IN MEXICO

by NEALE MACMILLAN

The puzzling tropical disease known as dengue fever and its more serious form, dengue hemorrhagic fever/dengue shock syndrome (DHF/DSS), continue to spread in all regions of the tropics. The disease presents a growing threat to lives and public health in Southeast Asia, the Caribbean, and the Americas. Some parts of Africa may also be at risk.

The spread of dengue is a familiar but grim story to medical and health specialists who attended an IDRC-sponsored dengue conference from February 18–20, 1987 in Merida, Mexico.

Unfortunately, medical science is still some years away from developing a vaccine against the disease. In the meantime, the main culprit spreading dengue viruses, the *Aedes aegypti* mosquito, is invading new territory. Dengue fever causes a fever lasting six or seven days and intense pains in the head, muscles, and joints, followed by a rash. DHF/DSS is a potentially fatal form of dengue to which children appear to be more susceptible than adults. An untreated child can die from the shock syndrome in as little as six hours after the onset of symptoms. Nosebleeds, bleeding from the gums, and hemorrhaging under the skin may also occur. In severe cases internal bleeding occurs even in the brain.

In Southeast Asia, dengue fever and DHF/DSS have been a major public health problem since the 1960s. During the last four years, record numbers of dengue cases and deaths have been reported.

Now there are fears that the tropical Americas also may be developing a serious dengue problem. Three of the four dengue virus serotypes are now circulating in the region and epidemics occur with increasing frequency. The first outbreak of DHF in the

Americas occurred in Cuba in 1981 (see accompanying article).

Research on various aspects of dengue fever is advancing around the world. Rapid diagnostic techniques are being developed and investigations are under way to improve the treatment of patients suffering from severe complications such as internal hemorrhages, severe hypotension (abnormally low blood pressure), and heart failure.

IDRC is supporting Malaysian researchers in an epidemiological study of children in a community near Kuala Lumpur. They are recording data on the prevalence of antibodies in the children and correlating them with other information such as knowledge, aptitude, and practices related to dengue. This makes it possible to determine the factors that put individuals at risk.

A Cuban dengue research project, which is also supported by IDRC, has identified various individual risk factors—such as asthma, diabetes, and sickle-cell anemia—related to the occurrence of DHF/DSS. There may also be a racial factor, since white people in Cuba proved more susceptible to the disease than blacks.

But efforts to develop a vaccine are hindered by a unique immunological feature of dengue viruses. Some 20 years ago Dr Scott Halstead, now associate director of health sciences for the Rockefeller Foundation in New York, attempted to explain this feature through his "sequential infections" hypothesis.

Dr Halstead, a participant in the Merida conference, observed that DHF/DSS usually occurs in people who already have antibodies to at least one of the four dengue virus serotypes. These antibodies either developed as

a result of a previous dengue infection or were passed on by the person's mother.

This hypothesis implies that any vaccine that is developed must adequately protect against all four dengue viruses if it is to be effective. Immunity to only one virus may actually improve rather than lower one's chances of developing DHF/DSS. This has made the World Health Organization's vaccine development project in Thailand a slow process. "My prediction, unfortunately," says Dr Halstead, "is that it could be up to the turn of the century before this vaccine goes through all the stages of testing."

Dr Halstead and other conference participants therefore recommend that efforts be devoted to controlling *Aedes aegypti*. "I think that's where we really need to try to push," he says. "It's crazy to have human beings breeding a dangerous vector mosquito in the drinking water and the rainwater around their property." Discarded, water-filled car tires are also a favourite breeding ground.

Dr Halstead notes that 13 countries in Latin America had eradicated this urban mosquito by 1950. But surveillance and control programs were relaxed and *Aedes aegypti* is back. It can develop resistance to insecticides, so the most effective means of control appears to be long-term, community-based programs.

In Cuba, Puerto Rico, Singapore, and Malaysia, laws have been passed to stop the spread of *Aedes aegypti*. The enactment of similar measures in other affected areas of the tropics may represent the only realistic hope in coming years of containing the threat posed by the dengue viruses. ■

Neale MacMillan is a Canadian freelance writer working in Mexico.

THE 'PLANNED' FAMILIES OF TUNISIA

by MOULDI HABCHI

If a young married woman doesn't want to have children for one, two, or three years, all she has to do is swallow one, two, or three small lead shots on the night of her wedding.'

Easier still, 'all she has to do is eat two raw eggs every morning—when one already has an egg in one's stomach, there is no room for any more.'

These formulas, and so many others, have had their day.

It was 30 years ago that Tunisia achieved independence and 20 years ago that it opted for a family planning policy designed to harmonize, in the long term, demographic growth with economic growth. Although people's methods have changed, birth control and family planning remain a major concern today.

Birth control services are now offered through more than 800 public sector centres in Tunisia—dispensaries, hospitals, family planning clinics, and mobile teams. Four married women out of 10 use some form of contraception and some 30 000 abortions per year are performed by services of the National Office for Family Planning and Population (ONPFP).

Two-thirds of Tunisians believe that religion views birth control favourably. But there are other sources of resistance to birth control—ones related to a woman's level of education, her status, and socioeconomic level.

The average number of children per woman decreases according to her level of education: from 6.9 among illiterate women, to 2.6 among women with a university education. The proportion of illiterate women in Tunisia is close to 50 percent with the level reaching as high as 75 percent among women over 30. These figures explain why the decline in the birthrate has been so slow. Efforts to date to provide the country with schools will have their effect mainly in the years to come.

Access to employment is also a major determinant of reproduction rates among Tunisian women. Women with jobs have an average of two children; those without jobs normally have more than four. The nature of the woman's job is also an important factor. Whereas executives have an average of 1.6 children (the level in Europe), the figure is three times higher among working class women, and reaches nine children among women in the farming sector. But in the final analysis, education levels have a greater influence on the declining birthrate than does employment.

Questioned about the ONPFP fertility survey that he conducted together with Rodrigue Beaujot, Mongi B'Chir says that the remarkable decline in the birthrate between 1966 and 1976 must be seen in the context of traditional Arab-Muslim societies which favour large families.

The survey, which was funded by IDRC, focused on 532 single, married, widowed, and divorced people, over 25 years of age. It was designed to examine the prevalence of family planning and define the reproductive behaviour of Tunisians. The survey revealed an appreciable drop in the fertility rate, reflected in a decrease of two births per household over the last two decades.

According to Mr B'Chir, "Tunisian society is still torn between two models: the traditional model, still preponderant among large segments of the population, who continue to believe that a large family provides security; and the modern model, a smaller family oriented toward consumption and comfort."

Apparently, the first model is losing ground: two-thirds of Tunisian women now subscribe to the modern family model.

Ninety percent of the people surveyed opt for a family of three to five children. Four children would be the ideal number ("neither too many, nor too few"), and seems to reflect a profound social imperative. A Tunisian saying often crops up: "Two children to tie a husband's hands, and two to tie his feet." A major factor would appear to favour this ideal number: family allowances are paid only for the first four children.

Despite the improvements of recent years, under the best-case scenario the reproduction rate would be 3.8 children per family at the turn of the century. And not until 2020 would a rate of 2.9 be achieved, which is still higher than the rate necessary for simple population replacement (2.1).

This downtrend would occur under the combined effects of socioeconomic and cultural changes—notably better education, urbanization, declining infant mortality, the gradual integration of the rural community into the national economy, and the popularization of birth control methods.

The changing social behaviour of Tunisians is also having an impact on fertility. Today, the health of a couple is no longer measured solely by the "harvest" of children. The social image which is clearly emerging is that of the couple who reflect on their concerns, particularly the issue of reproduction, and make decisions jointly.

Even the concept of housing is changing. Almost all the couples surveyed expressed the desire to have one room for the girls, one for the boys, and one for their parents. Western mores are indeed gaining ground. ■

Photo: Mouldi Habchi



A family planning worker interviews a mother in a Tunis suburb.

Mouldi Habchi is a Tunisian journalist working for the Agence Tunis-Afrique-Presse (T.A.P.).

Since 1984 a dedicated Pakistani professor has been helping school teachers in the isolated northern reaches of his country to do their jobs better. An evaluation team describes the experimental training program he operates for the Aga Khan Foundation as "extremely useful" and worthy of replication elsewhere in Pakistan.

Photo: Jean-Luc Ray



Pakistani teachers are advancing beyond the traditional philosophy of 'spare the rod, spoil the child'.

TEACHING THE TEACHERS IN NORTHERN PAKISTAN

by JOSEPHINE MACFADDEN

Professor Mubarik Hussain Shah's enthusiasm and commitment to his work are paying off. He has lived in the northern Pakistani city of Gilgit and has run the Field-Based Teacher Training Program from there since 1984.

"After my initial demonstration class," he explains, "I gather the teachers-in-training for their first impressions of the new teaching methods I have been demonstrating. 'What are the differences?' I ask them. It usually takes them a few moments before one will say, 'There's no stick.' 'Exactly!' I say. Then I have them.

"They can't help noticing that I have achieved discipline and an atmosphere of participation and learning without the use of physical violence, or the traditional method of unison chanting of information."

The experimental training program is jointly sponsored by the Aga Khan Foundation and the Pakistani Department of Education. The Aga Khan institutions began working in the Northern Areas of Pakistan in 1945 when, with the help of a large donation from its Ismaili leadership, it opened several schools. Since then it has worked diligently to fulfill its leader's instructions to educate children, especially girls for whom there were previously no schools at all.

The Northern Areas are rugged and isolated. They lie at the intersection of four of the world's highest mountain ranges—the Himalayas, Karakoram, Pamirs, and Hindu Kush—and border Afghanistan, the USSR, China, and India. About 90 percent of the population lives by subsistence farming, and the literacy rate of 10 percent is less than half the national average.

Gilgit is the main city of the Northern Areas. Until the paving of the historic silk road to China in the past decade, it was isolated—except for the intrepid traveller willing to fol-

low the winding dirt road suspended on the cliffs high above the Indus River. An airstrip has given mountaineers and other tourists access to the region, but fog often disrupts flights.

A research team from the Quaid-i-Azam University was funded by IDRC to evaluate the field-based teacher training program in this area. To this day there are virtually no roads linking the valleys, so in order to visit isolated schools, team members had to travel by jeep, horse, or yak, or on foot.

Such isolation mitigates against the teaching profession. Few teachers from the Northern Areas have had formal training. They simply begin to teach in the local village schools when their own schooling is completed. The methods by which they were taught become their own.

In order to break traditional teaching habits, the Aga Khan field-based method calls for teachers to be transferred to different village schools for nine months. During this time they are constantly supervised by a master teacher. Special manuals provide them with lesson plans and suggest appropriate techniques.

The teachers are encouraged to "use local events as learning experiences and aids, to get pupils more actively involved in learning through various practical activities and questioning patterns rather than rote memorization, to systematically evaluate pupil learning, to abstain from punishment and to use Urdu as the language of instruction."

Prof. Z.A. Ansari is Director of the National Institute of Psychology at Quaid-i-Azam University in Islamabad and led the evaluation project. His report is highly critical of the system of teacher training throughout Pakistan—one which has been in place since independence. He calls it "one of the most neglected areas of education".

Although Pakistan's 87 teacher training institutes have a capacity for 26 000 teachers, they are far from full. About 14 percent of male

teachers and 25 percent of female teachers enter service untrained.

The report argues that, for those who receive training, the standard one year is not enough. Furthermore, the lecturers themselves are not adequately trained and the "curriculum could do with a lot of improvement". There is too much theory and not enough emphasis on the art of teaching, the reports adds, and trainees are not given satisfactory instruction on how to motivate children or deal with behavioural problems.

It was against this backdrop of criticism of Pakistan's overall teacher training system that Prof. Ansari's team evaluated the Aga Khan field-based training program. The researchers specifically examined the backgrounds, attitudes, perceptions, and classroom skills of the participating teachers, as well as their students' learning behaviour, in order to assess the program's impact on teaching quality.

The evaluation report says the teachers give planned, structured lectures and offer clearer explanations and direction than conventionally trained teachers. Students' responses to questions and completion of class work indicate an increased learning capability.

Teachers punish students less and communicate with the class at large rather than focusing on individuals or specific groups.

Despite these promising results, participants in the training program do not stand out significantly from others in terms of innovative teaching styles. The report says this slow progress may be partly attributed to difficult conditions such as lack of teaching aids, materials, and funds.

The report recommends that information on the Aga Khan field-based training methods be disseminated so that model programs can be established in other areas of Pakistan. ■

Josephine MacFadden is a freelance writer based in Ottawa. She visited Gilgit, Pakistan, last December.

TUBERS ON A THOUSAND HILLS

by SYLVIE BÉLANGER

The tradition in Rwanda is that each child receive a part of the family land. In the Kinyarwanda language, this is called the *umunani*. The result is that with each generation the size of the plots decreases and the quality of the soil deteriorates.

Rwanda is a small landlocked country in the heart of Central Africa. It is bordered on the West by Zaire and to the East by Tanzania. Almost all its arable land is already occupied and the size of family holdings has shrunk to only about one hectare. Leaving any land fallow has become impossible and the use of chemical fertilizers is not common. The soil is exhausted and the yield is dropping. As if this weren't enough, there is a serious problem of erosion which creates deep ravines on sloping land.

Despite all this, Rwanda, which is known as the 'country of 1000 hills', looks like a garden even in the dry season.

result that the need to develop improved varieties adapted to the country's dozen agroclimatic zones has become pressing.

Cassava and sweet potatoes provide basic nutrition for 70 percent of the population. For lack of land, farmers have been forced to grow sweet potatoes in poor-quality soils such as those found in damp valley bottoms and marshes, and cassava in the dry eastern lowlands.

ISAR's improvement program for cassava and sweet potatoes is aimed at developing early high-yield varieties that are resistant to the prevalent diseases (anthracnosis and virosis) and insect pests. ISAR researchers are also studying better methods of farming and training personnel.

Since 1983 the project has had the support not only of IDRC but also of the International Institute of Tropical Agriculture (IITA). It should be advantageous for a number of East African countries because it aims to set up an

rich can afford to wait for the late varieties to mature.

As for cassava, it is increasingly being grown on new land, much of it at high altitudes between 1600 and 1800 metres to which local varieties are not adapted. At the moment, the yield of cassava is stagnant and the crops are falling victim to parasites and diseases, such as green cassava mites, mosaic, bacteriosis, leaf spot, and mealybugs. (The last-mentioned reached Rwanda from Zaire.)

The program funded by IDRC, which officially began in 1984, is intended to run for five years. As Mr Alvarez and Georges Ndamage, the agricultural engineer in charge of the sweet potato improvement work, explain, the process will take longer because it is being developed in the field with the farmers themselves. Their experience and reactions will be an integral part of the scientific work.

Several hundred varieties from other African countries have been introduced and are being grown in greenhouses at ISAR's Rubona Station, near Butare in the south of the country. Work is being done on hybridization and crossing of different local and imported varieties and the best of the resulting lines are selected.

Clones are then tested in different agroclimatic zones of the country with the participation of farmers selected by the Ministry of Agriculture. The farmers evaluate not only how well these varieties adapt to their soil but also how well they suit their nutritional preferences. They even taste test local or new varieties and check the fibre content. The two researchers consider the farmers' contribution to be extremely important.

The farmers will be the initial beneficiaries of the research and will also be the first to disseminate the improved varieties to other farmers.

At the Rubona Station, training courses on production and multiplication are being offered at regular intervals for groups of 10 technicians from different agricultural projects in the country. This is one of the best possible ways of carrying out ISAR's agricultural mandate and supporting the Government of Rwanda's farm policy. Léopold Gahamanyi writes: "More than it has in the past, agricultural research should reach out to the farmers and try to understand better the socioeconomic factors which impede production. Only if they have a thorough knowledge of the rural environment can researchers put forward new technologies to revitalize this important sector of Rwanda's economy."

Sylvie Bélanger, a Canadian, visited Rwanda recently as part of a project of the Fédération professionnelle des journalistes du Québec, funded by the Canadian International Development Agency.



Lack of farmland has led farmers to terrace and cultivate hillsides.

More than 90 percent of the people live by farming. It is the main economic activity. Now, with a population growth rate of 3.7 percent per year, Rwanda is faced with the problem of not being able to produce enough food to keep pace with its growing population.

Léopold Gahamanyi, director of the Agronomical Sciences Institute of Rwanda (ISAR), points out that 80 percent of the food produced in Rwanda is consumed by those who grow it. The production of subsistence crops has remained stagnant for several years with the

East African network for research in the improvement of tropical food tubers. There is a regional co-ordinator, Mr Nick Alvarez, and the project is IITA's main activity in this area of Africa.

According to Mr Alvarez, the production technology developed by ISAR for sweet potatoes is now the most advanced in East and Southern Africa. This is extremely significant because total production of sweet potatoes has been falling. In a traditional intercropping system, most local varieties mature late. There is a Rwandan proverb which says that only the

MICROFILM IS FOREVER

KEEPING INFORMATION FRESH IN ALUMINUM POUCHES

by GERRY TOOMEY

What do microfilm and cabbage rolls have in common other than the fact they both come in rolls?

The answer is that they both store well in aluminum foil pouches. So well, in fact, that the pouches are being used by Canadian and Indonesian documentation specialists to store archival microfilm—that is, microfilm documents that are supposed to last 'forever'.

The technology of packaging food in hermetically sealed aluminum foil has been around for many years. It has been used for products ranging from army rations, which have to store well under the toughest conditions, to more conventional consumer foods such as smoked meat and cooked cabbage rolls.

In 1975 the Swedish Archives reported on experiments they had conducted in which such aluminum pouches were successfully used to protect photographic film. The Bank of Canada, which in 1977 faced the prospect of an expensive upgrading of its microfilm storage facilities, saw the report and was impressed. It conducted its own experiments.

It has now been 10 years since the Bank began using the pouches to store archival microfilm documents pertaining to Canada's debt-management program. Their successful experience with the pouches prompted IDRC to investigate the potential of the technology for microform storage in developing countries. And two other Canadian institutions—Canada's Public Archives and the Metropolitan Life Insurance Companies—have also begun to use the system.

Microfilm is an excellent medium for storing important documents over a long period, perhaps as long as several centuries. Pages of information can be miniaturized and photographic film that has undergone proper chemical treatment is highly stable. In the hot and humid tropics, however, microfilm is especially at risk from its two arch enemies—mold and fungus.

To avoid the image deterioration caused by high heat and humidity, climate-controlled rooms are normally used for microfilm storage. For documentation centres in developing countries, this is not only a big expense, but sometimes a futile one. Frequent power failures and the practice of turning off the air conditioning at night to save money, for example, can result in the microfilm deteriorating faster than if it were stored in a room with no climate control at all.

With an aluminum pouch storage system, the expense of a climate-control system and its perpetual upkeep are replaced with the much smaller expenses of a desk-top vacuum-seal packaging machine (about CA\$12 200), nitrogen tanks and other accessories (\$3000), and

a supply of pouches (35 cents each). About 100 microfiche—with a capacity of 10 000 pages of text—can be stored in one 175 by 230 millimetre pouch.

Although the pouch system requires a piece of microfilm to be repackaged after every viewing, this is not a serious problem in the case of archival microfilm. Archival documents are considered master copies and there is rarely a need to take them out of storage. "When your working copy of the microfilm wears out, you simply go back to your archives, open the pouch, and make a new working copy," explains Ronald Archer, a program officer in IDRC's Information Sciences Division.

The IDRC-financed experiment at the In-

donesian conditions, several of the pouches prepared at PDII were intentionally stored under severe conditions, including a generator room with a high concentration of reactive chemical fumes. One pouch was even buried in a plant pot in the office of Ms Luwarsih Pringgoadisurjo, the head of PDII. She promised to water it faithfully every day along with the plant "in order to give it a good test"!

Six of these pouches also contained a spoonful of blue silica gel crystals to test for moisture due to improper sealing. The highly sensitive crystals turn pinkish brown if exposed to even minute amounts of water. When the pouches were opened after 15 months, the crystals were still blue. "The system was still running exact-

Photo: Denis Sing / IDRC



Aluminum pouches protect film from the effects of heat and humidity.

donesian Center for Scientific Documentation and Information (PDII), in Jakarta, began in October 1985. Donald Wilson, the Bank of Canada's records manager, and his colleague Diane Dumoulin, the Bank's microfilm supervisor, went to PDII to install and demonstrate the system and to train micrographics staff to operate and maintain it. Pouches were packed and vacuum-sealed by PDII staff.

During packaging of the pouches, a vacuum pump draws out all air. This includes atmospheric oxygen, the element that enables fungus and mold to grow and which is necessary for the chemical oxidation that blemishes photographic images. As the air is evacuated, the pouch is "back-flushed" with nitrogen which, being an inert gas, does not react chemically with the microfilm. The nitrogen keeps the contents of the bag perfectly dry. By giving form to the bag, it also acts as a cushion to protect the microfilm.

To test the quality of the packaging under

ly the way it was supposed to," says Mr Wilson, referring not only to the quality of the pouches but also to the vacuum-sealing operations.

It was Ronald Archer's idea to test the feasibility of using the Bank of Canada pouch system in Third World documentation centres. "It's an absolutely perfect solution to a storage problem that had been expressed to IDRC many times," he says. "And now the Indonesians have come back to us with a request to produce a training video on this system."

Meanwhile PDII staff are proceeding with the pouching of archival material, and three other groups—in Sri Lanka, Fiji, and Trinidad—have expressed an interest in the technology. ■

For more information, write to:

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HEALERS NEW AND OLD

MEDICAL CARE IN HAITI

by ROBERT LANDRY

As if its hooves knew every stone lying along the route, the little horse easily climbs the path carved in the hillside. Here the heat of Haiti vanishes, although the sun is sometimes strong.

The horseman, a white man with a moustache, does not understand why everyone—the woman with her bundles of firewood, the man with his hoe—keeps calling out to him: “Dokteù, Dokteù!” He finally concludes that the last white man to come here by horse must have been a mustachioed doctor who was busy trying to catch up on a few months’ worth of delayed rural health care.

Doctors rarely come to the hills. When the broken asphalt becomes earth, then dried riverbed, and finally a narrow path among the pebbles, even the best will weaken.

Not all regions of Haiti are this inaccessible, but most, with the exception of the large cities, suffer from an acute shortage of modern medical care. Of the US\$29 million that the Government of Haiti will spend this year on public health (averaging 81 cents for each man, woman, and child), the lion’s share will be spent in the capital, Port-au-Prince, and in a few cities of lesser importance. The rest will do little to help the 80 percent of the population that lives in the rural regions.

Outside Port-au-Prince, there is little or no health protection: only one doctor per 20 000 inhabitants, one dentist per 100 000. Thirteen children out of 100 die before their first birthday, 33 before reaching their fifth—victims of tuberculosis, malaria, and a range of diseases related to malnutrition and the absence of basic hygiene. The rural populations rarely have access to safe water.

With the absence of modern means of communication, the shortage of doctors, and the underfunding of health care, the hinterland is virtually left to itself. One example of this isolation is the rural portions of Thomazeau “commune”, a community of 32 000 people covering 290 square kilometres, whose main town is only 20 kilometres from the capital. For all practical purposes, Thomazeau is the end of the earth. It is also one of two communities that figured recently in a research project

conducted by Haiti’s Human and Social Sciences Research Centre (CRESHS) and funded in large part by IDRC.

The organization of primary health care by the Haitian community was the subject of the research, which was recently completed by CRESHS. Dr Jean-Baptiste Romain had selected two communes in the Department of West Haiti: Arcahaie, on the coast north of Port-au-Prince, and Thomazeau, in the north as well, but towards the hills that border on the Dominican Republic. The project’s objective was to examine the possibility of “using all means available”, as the World Health Organization suggested in 1977, to compensate for the shortage of qualified medical personnel. This meant harnessing all the resources of traditional Haitian medicine.

To provide modern health care to its inhabitants, Thomazeau has only three nonresident doctors, two nursing assistants, two health care aides, one health officer, and two inspectors. However, the commune has 250 to 300 midwives, 31 of whom have been trained and received diplomas, thereby earning the official title of “matrons”.

The large number of midwives is explained by the fact that families, which still harbour a fear of witchcraft, prefer to have relatives deliver babies. Most of these midwives are also herbalists, using plants and medicinal roots to treat illnesses.

There is also a group of healers who devote themselves to injections and dressings, administering the prescriptions that are occasionally obtained by patients from licensed medical doctors. These injection givers do not have diplomas.

Finally, there are the spiritual healers—the “houngans” or Voodoo priests, who also use plants while invoking the spirits, the “loas” of the African animist religions.

Can these traditional healers be integrated into a plan for delivering primary health care? The CRESHS team is convinced they can. The researchers were particularly struck by the fact that the peasants themselves seem to feel an urgent need to contribute to the bringing together of the various health workers, both traditional and modern.



A world apart: Many rural communities are visited only rarely by modern doctors.

The CRESHS team found that the traditional healers are well regarded, with the exception of the houngans, who are considered useful in treating certain “supernatural” illnesses, but usually viewed with a degree of scepticism. The herbal healers enjoy the greatest popularity. In nearly 60 percent of cases, the patients who used herbalists considered themselves cured or, at the very least, helped. The midwives, available at any hour of the day or night, even in the most remote regions, are also respected. The injectors are regarded as assistants to the licensed physicians, their main clientele being those patients who live far from health services and sometimes cannot travel.

In most cases, however, people have some reservations about traditional healers. The herbal doctors sometimes overstep the mark, and the injection givers sometimes administer medicines haphazardly, with syringes that may not have been properly sterilized. Only the midwives seem to escape criticism.

The official doctors occasionally get hauled over the coals: they are not always there when they are needed and often display an utter lack of understanding of the milieu. It is as if both traditional and modern health specialists had a way to go. But how?

CRESHS suggests that community action groups be given the job of promoting integrated health care programs. For their part, the community leaders appear to be aware of the need to link traditional medicine with the pursuit of the health objectives for the year 2000. And the healers, who often elevate their role to the level of the priesthood, seem disposed to cooperating with the medical personnel, perhaps in medical centres, under professional control, and in exchange for modest remuneration.

In the meantime, perhaps a sharing of knowledge—between the few available licensed doctors and the traditional healers—would be in order. And for the patients? Perhaps the combined benefits of an injection and a cup of specially prepared herbal tea? ■

Robert Landry is a freelance journalist who has visited Haiti several times since January 1986



Proud farmer with high-yield sunflowers in the Nile Delta.

Egyptians, whether in the town or the countryside, usually cook with oil. In the last 15 years their annual consumption of vegetable oil has quadrupled to reach the current figure of 12 litres per person. Soybean, sunflower, peanut, and sesame seed oil, most of it imported, has rapidly supplanted animal fat in cooking.

increase the yield. Production on experimental plots has reached 1500 kilograms of seeds per feddan (0.42 hectare), five times the normal yield of 300 kilograms per feddan. Even when the method was evaluated on farmers' fields, production tripled to 900 kilograms of seeds per feddan.

In the second stage of their work, the researchers have given their attention to transferring what they have learned to the farmers. Bit by bit the latter have become familiar with the high-yield varieties and the growing methods recommended by the researchers and the teams sent out by the Ministry of Agriculture to popularize them.

Breaking down myths

Research has shown that, for all their ancestral skills, the small farmers know relatively little about how to grow oil-bearing plants. Antiquated methods still persist and seriously restrict the yield. Sunflowers, for example, are planted at too low a density to produce a good harvest of seeds and oil. All too often they use nitrogen fertilizers which increase production costs without increasing seed production. Watering is mainly done in the daytime, which causes a disease that wilts the leaves and eventually kills the plant.

The agricultural extension agency of the Ministry of Agriculture decided to disseminate the new methods by using five selected farmers in each of the country's 24 administrative areas. Researchers used their fields to test both the varieties they had selected and the newly developed methods. This allowed the researchers to suggest options, listen to farmers' comments, and make any necessary changes.

The researchers discovered that oilseed farmers in the fertile Nile Delta already had a solid market for their produce, namely confectioners. This led them to concentrate their extension efforts on the poorer farmers on marginal lands who might use vegetable oil production as a way to increase their income.

To the desert

Dr Al Ahmar's team therefore moved into the 'new lands', the irrigated areas won from the desert. Work has already begun in the Governorate of Nubaria, an area reclaimed in 1952, about 50 kilometres south of Alexandria.

The researchers will closely monitor the growing of sunflowers and rapeseed under these conditions. These two crops were chosen as the most promising for desert regions. The team will visit producers at the crucial stages of planting, flowering, and harvest. They hope to incorporate feedback into the research process to ensure they are giving farmers the right advice.

Tests to date have demonstrated that the objective of producing half the oil consumed in Egypt by the year 2000 is attainable if improved varieties and methods are introduced and if desert soils are put to better use. Part of the justification for these hopes lies in a sunflower variety known as Giza. Fields in which it is planted have, under certain conditions, yielded up to 1.5 tonnes of seed per feddan—twice the yield of varieties currently in use.

On seeing the success achieved, the government wasted no time. It immediately decided to plant the new variety of sunflower on 100 000 more feddans. Meanwhile, the tests with sesame, rapeseed, and peanuts continue. ■

OIL FOR EGYPT'S KITCHENS

by ROBERT CHARBONNEAU

Egypt now imports three-quarters of the edible oil it consumes. In 1984 this represented an expenditure of US\$185 million. It is estimated that this will nearly double in the next 15 years.

Egypt could, however, become self-sufficient if such oil-bearing plants as rapeseed and sunflower were adapted to desert soils. There would be the added advantage that the byproducts could be used to feed livestock.

If a way could be found to increase local production, precious foreign currency could be saved. It would be possible, for example, to stop the expensive importation of soybean cake from Asia to feed Egyptian poultry.

Since 1978 Dr Badr Al Ahmar, a researcher at the Agricultural Research Centre of Egypt's Ministry of Agriculture, has been working on the problem. At first, with financial help from IDRC, he worked on improving the yield of oil from existing varieties of sesame, sunflower, and peanut. His research also included testing whether Canadian rapeseed could grow in Egypt's soil and sunlight. He was able to identify high-yield varieties such as the Mayak sunflower whose oil yield is 45 percent of the seeds' weight and which stands up to the high temperatures of Egypt.

Along with improving varieties, Dr Al Ahmar and his fellow researchers have developed improved methods for growing sunflowers which

REVERSING THE FLOW

AFRICA AND THE INTERNATIONAL DEBT CRISIS



Morris Miller

*Morris Miller is a Canadian economist and a former executive director of the World Bank. He is also author of the book *Coping Is Not Enough!* The International Debt Crisis, recently published by Dow Jones-Irwin, which examines, among other factors, the roles of the World Bank and the International Monetary Fund in the crisis. In this Reports commentary, he explains recent concern over Africa's debt problems and argues in favour of immediate forgiveness of Third World loans as a first step in averting international economic catastrophe.*

by MORRIS MILLER

In mid-1986, Third World debt passed the U.S.\$1 trillion* mark. Though Africa's collective share is only a tiny fraction of that, the world community has begun to turn its attention to the desperate financial predicament of that continent.

In early April, almost five years after the dramatic onset of the international debt crisis, UN Secretary General Perez de Cuellar announced the establishment of a 10-member Advisory Group on Resource Flows for Africa. Its purpose is to propose and activate measures to provide immediate help to the financially troubled countries of Africa.

Then came the mid-April meetings of the World Bank's Development Committee and the International Monetary Fund's Interim Committee, which brought together the world's finance ministers. It was largely devoted—to quote one source—to “a fundamental reassessment of Africa's ability to shoulder the burden of its foreign debt”. The reassessment was intended to lead to action on this issue at the June economic summit of the seven leading industrialized nations.

These two initiatives followed hard on the heels of two moves by the World Bank: the establishment of the Special Facility for Sub-Sahara Africa, and its decision to raise Africa's share of its low-interest loans from 37 to 50 percent, which amounts to an extra \$600 million per year. The Special Facility, for which US\$1.7 billion has so far been pledged, aims to supplement financial flows to the region—on an emergency basis.

Given that numerous debtor nations in Latin America and Asia are also striving painfully and often vainly to cope with their debt burden, it is pertinent to ask: why the focus on Africa? After all, the largest debtors are elsewhere. Brazil and Mexico, for example, each owe more than \$100 billion, a sum greater than the combined debt of all the African countries.

Furthermore, it is only the dozen or so large-scale debtor nations that have the potential to pose a threat to the world's financial system. Their confrontations with private bank creditors command the headlines. Brazil's decision in late February to suspend its debt servicing payments is a good example. This action sent powerful tremors through the world's financial centres and there was even fear it might trigger a sequence of events cataclysmic for the global financial system itself.

Awareness of Ethiopian famine

Why then this focus on Africa at this time?

Part of the answer has to do with awareness of the Ethiopian famine. Heart-wrenching images reached into hundreds of millions of homes via television and other media. As UNICEF's deputy executive director, Richard Jolly, pointed out: “The outpouring of popular support followed when the ordinary television viewer saw what was happening [and] the dramatic change in

government policies and support followed after that.”

The concern for sub-Saharan Africa can, therefore, be seen as a cry of conscience—once the window on that tragic reality was opened to a wide audience.

It is but a small intellectual step to extend one's awareness of drought-generated famine in one country to the predicament of Africa as a whole, and to include in this litany of woes the much subtler, but no less serious, “societal costs” of ubiquitous poverty. The momentum of awareness created by an emergency such as famine has to be maintained in order to secure widespread appreciation of the longer-term tragic effects of the deep ‘poverty trap’ in which ordinary Africans are caught.

But the face of poverty is not as dramatic as that of starvation. There are far fewer graphic images available to show the outside world the human consequences of grossly inadequate funding for health, education, nutrition, and housing.

Africa's deteriorating condition is accentuated by the debt crisis. Extremely scarce funds must be allocated to service the more than \$4 billion of interest annually owing on the continent's foreign debt. Payment arrears now amount to more than \$12 billion, or one-fifth of their medium and long-term debt. Countries must forgo essential imports for immediate consumption, for maintenance of basic infrastructure, for investment in new facilities, and for the provision of basic services in the fields of health, education, housing, research, and so on. Julius Nyerere, former president of Tanzania, put the issue succinctly when he warned creditors that his and other governments are being forced to choose between repaying

their debt and starving their children.

A few broad-brush statistics on sub-Saharan Africa illustrate the current situation. Over the decade from 1972, the year before the “oil shock”, the region's collective debt grew from about \$7 billion to almost \$60 billion—or about 20 percent per year. This far exceeded growth in export earnings and income. The “debt shock” of 1982 drastically slowed the *rate of increase* of their borrowings, but of course the total debt continued to grow. Some 30 countries now have debts more than three times greater than their annual export earnings. The significance of this ratio can be better appreciated by noting that, on average, these countries must allocate 40 percent of their export earnings to debt servicing.

Negative transfers

The problem is exacerbated by the fact that most of this is owed to governments and to the multilateral institutions, namely the World Bank and the IMF. In 1986, the IMF took \$400 million more from these African countries than it put in. And this negative transfer phenomenon will soon apply to World Bank operations in Africa, if it doesn't already. Canadian journalist Michael Valpy portrayed the problem rather graphically in observing that African leaders have been forced to adopt measures that are “cannibalizing their countries”.

The result is reflected in the cold statistical record: food production is increasing at only half the rate of population growth; manufacturing contributes less than 10 percent to the GNPs of these countries and is structurally at the same stage of development as it was a quarter-century ago; average real per capita incomes have been falling by about 1 percent per year since 1974. One-

* All sums are in U.S. dollars

half to three-quarters of the population subsists on income levels characterized by the World Bank as "absolute poverty". African countries have the unhappy distinction of having the worst rankings on the 'misery index'—life expectancy, adult illiteracy, and infant mortality.

So, poor countries are being called upon to maintain a net flow of resources to the rich. Little wonder that 22 countries of sub-Saharan Africa have had to reschedule their debt a total of 87 times since 1975!

It is against this background that ways are now being sought to provide more capital to these countries. But the financial and other resources projected and promised, helpful as they may be, are not enough to maintain living standards even at today's intolerably low levels. The U.S. White House Task Force to End Hunger in Sub-Saharan Africa, for example, estimates that an extra \$4 billion will

in the present arrangements will spur donor governments to contribute more. The initiatives of the UN, the World Bank, and other institutions are more than a compassionate response to a deplorable situation. They also serve as a danger warning and draw attention to the hardships imposed on the people of these debtor nations. This sense of danger can be a powerful force since it reinforces good conscience with a heavy dose of pure self-interest.

Once there is a widespread awareness that desperate conditions breed desperate measures, a range of future scenarios becomes relevant. Among them is a doomsday scenario which could well happen should some debtors declare outright default or quietly default de facto on their obligations. Such actions could trigger a chain of events

scenario. The approach can be described as multiyear debt rescheduling on a case-by-case basis, in which the unpaid portion of the interest owed on the debt is added to the total, a practice known as "capitalizing" the interest. Thus, the debt of all developing countries is now astronomical: more than \$1000 billion, compared with about \$700 billion in mid-1982. During that period, however, living conditions in the debtor developing countries have deteriorated. It is as if the debtors are being forced to run up a down escalator. Little wonder they are tired and, with little or no prospect of a turnaround, discouraged. As the will to service the debt wanes with each passing day, the situation becomes more fragile and unsustainable.

As yet there is no light at the end of the tunnel, no glimmer of hope. World commodity export prices, in real terms, continue to remain at sub-basement levels. Export markets are stagnating or even shrinking. And protectionist barriers in the industrialized countries grow ever higher. To forestall the doomsday outcome which these trends make increasingly probable, the voting citizenry of the creditor countries must be aware and informed. They must use their votes to translate that concern into sustained government aid and related policies.

As a first measure, the flow of resources must revert back to the traditional pattern—from the rich to the poor. Debt forgiveness is an immediate step. If it is not done deliberately and overtly, it will happen haphazardly. It is more a question of how it is to be achieved than when.

Debt-equity swaps

The wall of stubborn resistance by bankers is beginning to crack. Banks have begun to write down the value of loans to the Third

World and to sell those loans at heavily discounted prices. This write-down often takes the form of "debt-equity" swaps in which banks sell loans at a discount in exchange for shares in companies in the debtor country.

And there are other proposals that would write down the value of the debts in an organized manner tantamount to a contribution from the rich to the poor. Such proposals are premised on the view that the negative transfer must be reversed immediately and that the positive flow to the debtor countries must be on a large scale. This reversal is but one condition of global recovery, but it is an essential and pressing one.

It is also essential that available resources, financial or otherwise, be used more effectively. Special attention must be given to a host of factors, two of the most critical being training and research. This is where agencies such as IDRC can play an important role on the global scene.

In the world of today there is no excuse for poverty tomorrow. Sub-Saharan Africa is a tantalizing challenge in its most extreme form. To hope to go beyond debt relief to the elimination of poverty may be regarded as optimistic. Whatever the judgment on that score, it is widely recognized that current arrangements are unsustainable and that a deep-seated and widespread crisis, of which the debt problem is but one manifestation, will force profound changes on us all.

The pain of the "adjustment" that is called for cannot be localized for long in an interdependent world such as ours. It must be shared, voluntarily or otherwise. ■

Debt forgiveness is an immediate step. If it is not done deliberately and overtly, it will happen haphazardly.

be needed annually. This is over and above both the \$8.5 billion these countries are actually expected to receive annually and the relief provided by the rescheduling of the \$7 billion required to service the debt.

It would be naive to think that pangs of conscience over inequities

leading to economic disaster. By that stage the debt issue would have gained world attention—but too late for preventive measures.

The current approach to managing the debt issue is, in my view, helping to incubate the doomsday

In Brief

Housing for the poor

IDRC has created a new research program in recognition of the growing need for better Third World housing technology and of the UN's declaration of 1987 as the International Year of Shelter for the Homeless.

The new program, called Building Industry, Materials and Technologies, is intended to bolster research aimed at improving shelter for the poor in developing countries. It will be administered by IDRC's Cooperative Programs Division.

For more information, write to:

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IDRC Cooperative Programs
P.O. Box 8500
Ottawa, Canada K1G 3H9

Africa Prize

The Hunger Project has created an annual prize of US\$100 000 to honour individual Africans who have exhibited exceptional leadership in the fight against hunger.

The Africa Prize for Leadership for the Sustainable End of Hunger "focuses on individuals working in such arenas as public policy, science, agriculture, education, and health whose leadership and policies reflect courage, initiative, creativity, boldness and, in some cases, personal sacrifice." The 1987 prize will be presented in September.

The cash award is intended to support the winner's continuing work on behalf of Africans.

For more information, contact:

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The Hunger Project
One Madison Avenue
New York, NY 10010
USA

Social forestry award

The first winner of the John G. Bene Fellowship in Social Forestry — a new award administered by IDRC — is Paul J. Martins, a graduate student in forestry at the University of Toronto in Canada.

Mr Martins has worked on forestry projects in Brazil, Costa Rica, and India. The award recognizes his research on forestry in the Indian Himalayas and will allow him to return to India to share the results of his work and to show how it can be adapted to different regions.

The Bene Fellowship, which is open only to Canadians, will be an annual CA\$5000 award, renewable for up to three years. The money will be provided by an endowment established by the late John G. Bene, a pioneer in the field of social forestry.

John Bene grew up in Hungary and emigrated to Canada in 1938. After a successful career in the forest industry in British Columbia, Mr Bene devoted his skills to Canada's international development program. He was a member of IDRC's first Board of Governors and inspired the creation of the International Council for Research in Agroforestry (ICRAF) in Kenya. Mr Bene died in April 1986.

The Bene Fellowship covers graduate or doctoral studies that focus on the relationship of forest resources to social, economic, and environmental welfare — particularly in the Third World.

Candidates for the fellowship may apply through IDRC's Fellowships and Awards Division. The annual deadline for applications is January 1.

Popularizing science

Science Writing in Asia: The Craft and the Issues was originally conceived as a slim on-the-job guide for Asian mass media science writers. Over a period of four years, however, it grew into a 256-page book which was launched in Manila early last May.

One of the three authors, Adlai Amor, training director of the Press

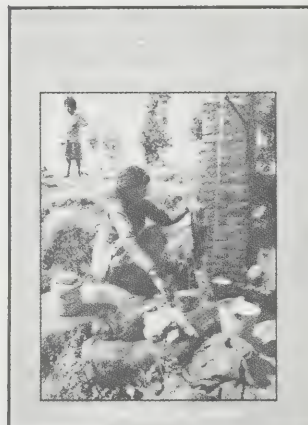
Foundation of Asia (PFA) which published the book, says a second printing in a newsprint edition is envisaged, as well as possible translation into Thai, Bahasa Malaysia, and perhaps Japanese.

The Philippine Journalism Educators Association has adopted the IDRC-sponsored book for use in journalism science-writing courses.

The book is the outcome of a series of IDRC Communications Division experiments aimed at raising scientific literacy — and possibly speeding up regional development — by encouraging Asian journalists to write popularized articles on science and technology.

The other two authors of *Science Writing in Asia* are Filipino Paul Icamina, science editor of PFA's weekly DepthNews service, and Mack Laing, associate professor in the University of Western Ontario's Graduate School of Journalism, in London, Canada.

Mr Laing set up the Science Service of DepthNews in Manila between 1976 and 1978 with IDRC support. Mr Icamina continues to put out science stories and columns for use by some 200 Asian newspapers and several hundred radio stations.



Waterlines

Waterlines is a quarterly magazine about appropriate technologies in water supply and sanitation for developing countries. Published out of London, U.K., by Intermediate Technology Publications Ltd., it reports on current projects and programs in the field, and describes and assesses a variety of technologies.

Waterlines was first published in 1982, with financial assistance from IDRC, as a way to promote the goals of the UN Water and Sanitation Decade. IDRC continues to support the magazine.

Each issue of *Waterlines* contains three or four articles on a selected

subject, as well individual articles on other topics and a technical brief on a specific technology (rain harvesting, for example). The technical briefs — normally illustrated with line drawings — provide a simple introduction to subjects of interest to fieldworkers.

Subscriptions are available from IT Publications, 9 King Street, London WC2E8HW, U.K. The cost is US\$15 for individuals and US\$19 for organizations.

If you have news to publicize, a story to tell, or practical advice to give, write to the *Waterlines* editor, Corwen McCutcheon. Articles of 1000 to 2000 words will be considered for publication. Letters to the editor are also welcomed.

Lighting up the world

Over 1.7 billion people in developing countries do not have access to electricity, reports the Worldwatch Institute in its publication, *Electricity for a Developing World: New Directions*. These people "at the bottom of the electricity totem pole" live in villages without lights or other benefits of electricity.

Between 90 and 95 percent of the electric power investments in developing countries go to providing power to large cities and industries. And yet, writes author Christopher Flavin, "in most villages people believe that electricity improves their standard of living more than any other change they have experienced."

Even small amounts of electricity can bring sweeping changes to rural dwellers. Electric lighting allows schoolchildren to read in the evening and extends the work day. Electric pumps, radios, and fans make life easier.

Although budgets for electrification have grown rapidly since the 1950s, they are now a large burden on many countries, requiring some 25 percent of public capital investments. But "Third World utilities have neglected the potential to increase the efficiency of electricity use. Electricity can be saved in homes and industries at less than the cost of developing new supplies," writes Flavin. He maintains that more attention has to be paid to the special energy needs of villages and recommends decentralized energy schemes such as small hydro-power plants, windpower, photovoltaics, and hybrid systems that use local resources.

Flavin also advocates the establishment of rural electric co-ops and the linking of electrification to other appropriate energy and development programs such as the introduction of more efficient cookstoves.

For information, write to:

Worldwatch Institute

Paper No. 70

1776 Massachusetts Avenue, N.W.
Washington, D.C. 20036
USA

Ania Wasilewski
Ottawa

Demographics of poverty

Different population growth patterns are separating the world into two halves — one where living conditions are improving, the other where they are deteriorating. That is the theme of a recent publication from the Worldwatch Institute entitled *Our Demographically Divided World*.

Co-authors Lester Brown and Jodi L. Jacobson write that much of the developing world, where population growth is rapid, is sliding into ecological deterioration and economic decline. But in the industrialized world (including China) "where population growth is slowing, rising living standards and falling fertility are reinforcing each other."

Many developing countries are caught in a "demographic trap" where increasing birthrates are resulting in overwhelming stresses on life support systems and downward spiralling economies.

Brown and Jacobson discuss the ways in which rapid population growth is exceeding the carrying capacity of the land in many countries — in Latin America, Africa, India, the Middle East, and Southeast Asia. The World Bank estimates, for example, that within a particular group of seven West African countries under study, a population of 21 million could be sustainably supplied with firewood. The population of these seven countries, however, is already more than 31 million.

The authors also point to countries such as China, Thailand, and Zimbabwe which are escaping from the demographic trap. The way out is in the direction of "national leaders' commitment to reduce fertility, the widespread availability of family planning services, and a public education program that links population growth to long-term social interests as well as to benefits for individual families."

The report was sponsored by the UN Fund for Population Activities.

For more information, write to:

Worldwatch Institute

Paper No. 74

1776 Massachusetts Avenue, N.W.
Washington, D.C. 20036
USA

Lorne Peterson
Ottawa



Small Ruminant Production Systems in South and Southeast Asia

Editor: C. Devendra

IDRC-256e, 414pp

This publication presents the results of a meeting held in Bogor, Indonesia, 6-10 October 1986, on the assessment of small ruminant production systems in South and Southeast Asia. It considered the prevailing circumstances, the innovations, and the strategies for stimulating increased productivity of goat and sheep operations. The present patterns of production were examined in detail with reference to the characteristics of the small farms, existing management methods, and the nature and components of the production systems. The discussion of the systems was further highlighted by country case studies and by consideration of issues and policies regarding available production resources (especially genetic and feed resources), constraints to production, and potential means to achieve desirable improvements. An important session was devoted to examining methodology, strategies for development appropriate to individual systems, and a conceptual framework for on-farm economic analysis.

Evaluation in National Agricultural Research

Editor: Douglas Daniels

IDRC-254e 162pp

Interest in the potential role of evaluation in improving the management of research is growing. The use of evaluation, however, is probably one of the weakest areas of management at present. Although there is a large body of literature on evaluation methodologies and the procedures for carrying out evaluations, little has been published on what evaluative information managers require and how this information can be most effectively gathered in a national research program. A workshop, held in Singapore from 7-9 July 1986, examined a number of case studies that document the present level of evaluation activities in different national programs and institutions. Participants used this case study material and their practical experience to reach consensus on some aspects relating to the different uses and users of evaluation, the role of evaluation in the planning process, and how to organize and implement an evaluation program in different types of research organizations. One session was devoted to reviewing the evaluation activities of external donor agencies. An alternative approach was suggested that would be more effective in the long run for both national programs and donor agencies.

In addition to IDRC *Reports*, the Centre publishes a wide range of material on development issues. These include scientific monographs, reports, and bibliographies on specific IDRC research areas, as well as general interest literature. These publications represent research interests and activities supported by IDRC in agriculture, food and nutrition, population, health, education, information, and social sciences. Films describing the Centre and some of the areas of development research are also available. A catalogue of current material, publications or films, is available from the nearest IDRC regional office or from IDRC in Ottawa (see page 3 for complete addresses.)

Publications may be ordered from the IDRC sales agents listed here.

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VOLUME 16, NUMBER 4 — OCTOBER 1987

Reports

THE
IDRC



After the
harvest



Pesticide poisonings underestimated?

I read with great interest Ania Wasilewski's "The Quiet Epidemic: pesticide poisoning in Asia" (January 1987). I agree wholeheartedly that the problem is one of major proportions, but that it has yet to be accorded the priority it deserves in public health and agricultural extension.

There is a danger, however, that we are only seeing the tip of the iceberg if we rely on reports of morbidity and mortality from hospitals and clinics. Both the 1973 World Health Organization study (that estimated some 10 000 deaths worldwide from poisoning, not the 900 stated in the article) and Dr Jeyaratnam's research relied heavily on such data. In developing countries, the rural poor often have difficulty in getting to health care or may avoid such services because of the cost involved in treatment. Those who do obtain medical attention may be misdiagnosed; this is true both of chronic poisoning, as the article points out, and of acute intoxication.

In Central Luzon in the Philippines, Dr Nelia Maramba found that rural physicians frequently misdiagnosed acute organophosphate poisoning as a variety of cardiovascular and respiratory diseases. Returning to this area several years later, I found that death rates among rural men, calculated from civil registries, had increased 27 percent, comparing the periods before and after insecticides were widely adopted. The increase was greatest both for diagnosed pesticide poisoning and for the conditions likely to be confused with it. Most mortality occurred in the months of the year in which spraying was concentrated. Death rates among women, children, and men in a nearby urban centre, on the other hand, continued their earlier decline.

Central Luzon is similar in many ways to other regions in the Third World where small farmers use pesticides and my research suggests

that the extent of poisoning is greatly underestimated. A clearer appreciation by policymakers and farmers of the magnitude of the risk is necessary if alternatives to sole reliance on pesticides are to be developed, promoted, and adopted.

Dr Michael Loevinsohn
IDRC
Ottawa, Canada

Editor's note: Dr Loevinsohn is a program officer in IDRC's Agriculture, Food and Nutrition Sciences Division. The study to which he refers was conducted between 1981 and 1983 while he was a researcher at the International Rice Research Institute. His findings were reported in the June 13, 1987 issue of the journal The Lancet, 1359-1362.

Wanted: a Japanese Marshall Plan

The world needs a massive Japanese Marshall Plan of untied concessional aid. Your excellent articles in the July issue highlighted the Third World debt crisis. A massive Japanese program of Official Development Assistance (ODA), i.e. grants or long-term aid at low interest, would help the Third World debtor countries to meet their loan repayments and still have foreign exchange to import raw materials needed to expand their economies. (The new Japanese program announced in April involved primarily recycling Japanese export earnings at market rates of interest and included relatively little funding for foreign aid.)

The United States also faces an extremely serious problem: a huge foreign trade deficit. If large amounts of Japanese aid were made available which could be spent anywhere in the world, the developing countries would undoubtedly use a significant part of the Japanese aid to increase imports from countries such as Canada and the U.S. These developed countries should then be able to avoid protectionism and provide Third World countries greater access to their markets.

Japan, too, is facing serious problems. It has an extremely high internal savings rate, with savings being much higher than internal invest-

ments. Normally, such an imbalance would result in economic stagnation. The Japanese economy has been able to grow for one basic reason: the "excess" internal Japanese savings have financed trade surpluses with the United States and other countries. As the value of the yen increases, Japanese exports become less competitive and less profitable. As a result the Japanese rate of growth is becoming more and more difficult to sustain. If Japan were to undertake a massive foreign aid program, Japanese exporters would find that they have additional market opportunities abroad.

The Japanese government and people face an historic choice, similar to the situation of the United States just before the inauguration of the Marshall Plan after the Second World War: the world economy is in serious trouble, with many countries under pressure to embark on programs that will result in a reduction in world trade and international capital flows. A massive Japanese program of untied aid on "ODA terms" could turn the tide and help the world economy to provide increasing standards of living for all countries.

John T. Craig
Economic Consultant
Washington, D.C.
U.S.A.

Probability and honesty

John T. Craig, in his letter to *Reports* (April 1987), has pointed out that the probability of success of a project may be very low if it depends on the simultaneous implementation of several conditions, even if each of these conditions is quite probable. Sensitivity analysis, such as examining the viability of an agricultural project if yields are 20 percent lower or costs 20 percent higher, is a partial and inadequate solution.

It is important to examine why over-optimistic evaluations are made. The department requesting a feasibility

study usually wishes to get a loan to carry out the project. If the consultant indicates that the project is unsound, then the department is not likely to be pleased. To make an agricultural project look good, it is by no means uncommon for an economist or administrator to adjust the yields upward so that a satisfactory rate of return can be quoted in the report.

A more serious problem arises when the consultant administration deliberately suppresses technical findings, even using direct threats of dismissal. This has happened in at least one case on transmigration projects in Indonesia.

Craig's idea of making a guesstimate of the probability of success of each condition is valuable, but some people would not approve of an honest guesstimate. Perhaps lending agencies should require that each scientist making an input to a report should provide a *confidential* list of the probabilities of success of the important conditions. The probabilities would be subjective and arguable.

This approach would tend to correct the dangers in some reports. It would be some trouble to implement, but changes are needed. The poor results of many overseas projects have been one cause of the debts of Third World countries.

G.M.F. Grundy, P.Ag.
Consulting Agrologist
Pointe Claire
Quebec, Canada

Your feedback is appreciated

The staff of Reports welcomes letters of comment and information from readers. Perhaps you're engaged in development work related to the projects described in the magazine. If so, other readers may be interested in what you have to say. Or if you wish to take issue with an article or clarify certain points, drop us a line. Letters, which should not exceed 250 words, are normally edited. Write to:

The Editors
IDRC Reports
P.O. Box 8500
Ottawa, Canada
K1G 3H9

Reports

THE IDRC

Cover photo: A young girl with millet flour in Zimbabwe. Between production and consumption of such food, there is much labour. See articles pages 4-15.



Photo: Denis Marchand

CONTENTS

Letters

2

OUR THEME THIS ISSUE: AFTER THE HARVEST

Sorghum's knight in shining armour

4

Botswana is buzzing with dehullers — devices that take the drudgery out of preparing the country's favourite cereal. *By Ozzie Schmidt and Gerry Toomey.*

Beefing up the Pakistani diet

6

Preserved beef can be added to traditional dishes to boost their protein content. *By Art Holbrook.*

Rating beans

7

Some beans harden during storage. How hard is too hard for Guatemalan consumers? *By Anne Fisher.*

Value-added fish

8

Chilean researchers show that small fish can be processed into profits.

Sun and software in Sierra Leone

9

Computer modelling takes the trial and error out of designing solar rice dryers. *By John Eberlee.*

Togo's maize bugs are in for a big surprise

10

Twelve hints for reducing maize losses due to hungry insects. *By Souleymane Ouattara.*

The fresher, the better

12

The rural Kenyans pulling in the fish aren't pulling in their fair share of the profits. *By Andrea Prazmowski.*

After the harvest

14

Postharvest services not only cut food losses but also improve nutrition and provide jobs. *By Ed Weber.*

Science and the printed word

16

Keep it simple, make it interesting. Budding scientific editors learn the art of clear communication. *By Ian Montagnes.*

Tunisia breathes a sigh of relief

17

Phosphate dust covers mining towns but a study shows it isn't a serious threat to people's lungs. *By Hamida Ben Salah.*

Artisans of development

18

In Niger, young artisans' enterprises get a boost from the ILO. *By Michel Fromont.*

ICRAF: A decade of agroforestry

20

Happy 10th birthday to the organization devoted to the science of growing trees and crops together. *By David Spurgeon.*

Beautiful, functional rattan

21

Tissue culturing may provide a way to regenerate this lucrative but dwindling forest resource of Malaysia. *By Mark Timm.*

Whose homeland?

22

Tribal people in the Philippines are trying to use the law to gain ownership of their ancestral lands. *By Mark Timm.*

Leishmaniasis — debilitating, disfiguring and sometimes deadly

23

Reported cases of this neglected disease are on the rise. Scientists meeting in Ottawa look for better control measures. *By Cheryl Ferguson.*

One child or two? China's rural-urban split

24

China's population policymakers are scratching their heads over a recent mini baby boom. *By Carol Vlassoff.*

Briefs

26

News and trends in international development.

New releases from IDRC

27

IDRC

The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in five sectors: agriculture, food, and nutrition sciences; health sciences; information sciences; social sciences; and communications. IDRC is financed solely by the Parliament of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are located at 250 Albert Street, Ottawa, Canada (P.O. Box 8500, Ottawa, Canada K1G 3H9). Regional offices are located in East Africa (P.O. Box 62084, Nairobi, Kenya); West Africa (B.P. 11007, C.D. Annexe, Dakar, Sénégal); Asia (Tanglin P.O. Box 101, Singapore 9124, Republic of Singapore); South Asia (11 Jorbagh, New Delhi 110003, India); Latin America (Apartado Aéreo 53016, Bogota D.E., Colombia); and the Middle East (P.O. Box 14, Orman, Giza, Cairo, Egypt).

The IDRC Reports

The IDRC Reports and its companion editions in French and Spanish — *Le CRDI Explore* and *El CIID Informa* — are published quarterly by the International Development Research Centre. Their aim is to keep readers informed of the activities of IDRC and to present articles on subjects related to the Centre's fields of interest. An Arabic version *بحوث للتنمية* is published annually. Copies are available on request from the Communications Division, IDRC. *Editor-in-Chief:* Jean-Marc Fleury. *Associate Editors:* Gerry Toomey (English edition), Robert Charbonneau (French edition). *Spanish edition:* Stella de Feterbaum.

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ISSN: 0315-9981

SORGHUM'S KNIGHT IN SHINING ARMOUR

A small Canadian device for removing the hulls from dryland grains was redesigned in Botswana where it has spawned a milling industry and reduced women's drudgery. The technology, which last year won an international technology prize for the African organization that perfected it, is now being adapted and tested in Zimbabwe, India, and elsewhere.

OZZIE SCHMIDT and
GERRY TOOMEY

Grains aren't really food until they have been processed into palatable form. In the case of sorghum and millet — two important cereal crops for millions of people living in the world's semi-arid regions — the outside layer or hull of the kernels is usually removed before the grain is eaten. This gives the grain, or the flour made from it, a more acceptable texture when cooked.

The labour involved in this daily "dehulling" chore is monotonous drudgery for the women and children who do it. The grain is first soaked in water, then pounded by hand using a mortar and pestle. In Botswana, it takes about four hours a day to dehull enough sorghum for a family of five.

In 1981, sorghum and millet accounted for 28 percent of Africa's cereal production. Despite their important position in the continent's food system, they still represent only a small fraction of the cereals bought and distributed by official grain marketing agencies.

In some countries, sorghum and millet are still viewed as 'poor people's food'. Grown and eaten mainly by rural farmers, they are of little commercial interest to big urban-based milling enterprises.

In recent years, consumer tastes in Africa have begun to shift. Even though sorghum and millet stand up well to drought and can therefore enhance a country's food security, Africans are showing a growing preference for rice, wheat, and prepackaged maize meal — no-fuss status foods, often imported.

In the early 1970s, IDRC began funding a series of research projects on the mechanical dehulling of sorghum and millet. The idea was to find a way around the 'post-production bottleneck' that was gobbling up so much of rural women's time and relegating millet and sorghum to the status of second-class foods. It was evident that efforts to breed better varieties of these crops would be wasted unless processing techniques were updated.

The starting point of IDRC's initiatives was a barley thresher modified for dehulling by the Prairie Regional Laboratory (PRL) of the National Research Council of Canada. The PRL (later renamed the Plant Biotechnology Institute) also designed a mini-dehuller as a lab tool for testing the dehullability of small samples of grain produced by breeding programs. These



Photo: Rowan Shirkie

RIIC dehuller: motor-driven abrasive discs replace muscle-powered mortar and pestle.

two prototypes became the jump-off points for experimental projects in various African countries, India, and parts of Latin America. These efforts have spawned several variants of a basic dehuller design, some of which are on the threshold of widespread use in semi-arid areas of Africa and Asia.

Botswana's new milling industry

Some initial experimentation in Nigeria demonstrated the PRL dehuller could be used on local sorghum, millet, and cowpeas. And in the Gambia, the Catholic Relief Services introduced a modified mini-dehuller that handles small batches of grain up to 5 kilograms.

It is in Botswana, though, that the dehuller has undergone the most sophisticated development, not simply as a discrete piece of hardware but as a complete food processing system, including machine design, manufacture, testing, training, consumer surveys, information dissemination, and public policy. Some aspects of this evolution were planned from the start; others, though natural offshoots, were unexpected.

Last year, the organization in Botswana that developed the system, Rural Industries Promotions, won the first International Prize in Development Technology. The competition for

the award was organized by the International Centre for Peoples' Development in Genoa, Italy.

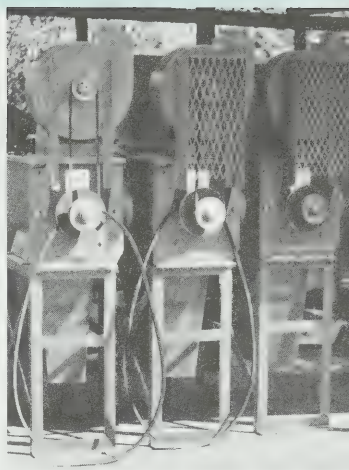
The Botswana experience is a complicated success story, complete with the internal conflicts to be expected when a major component of a country's food delivery system is radically altered. Above all, it is a story of intricate collaboration, over many years, between various government departments and agencies, technical innovators, mill owners, consumers, IDRC, and several other organizations.

In the mid-1970s, the Botswana Agricultural Marketing Board replicated an earlier Nigerian operation by setting up an experimental sorghum flour mill that included two of the Canadian dehullers. Although the mill was a continuous-flow operation unable to process individual customers' small batches of grain, its experience confirmed that rural and urban consumers liked flour made from dehulled sorghum and were prepared to pay for it.

In 1977, the Rural Industries Innovation Centre (RIIC) entered the picture. RIIC, which is an arm of Rural Industries Promotions, a private, nonprofit development company in Botswana, was already well aware of the 'dehulling-by-drudgery' phenomenon and therefore went to work adapting the PRL dehuller to rural needs. It added a trap door so



Left: The heart of the dehuller is a set of closely spaced discs that rotate quickly, rubbing off the unpalatable coating on each grain of sorghum. Right: In Kanye, Botswana, brand new dehullers made by a local firm await inspection at RIIC.



that grain could be removed from the machine at any time. Thus, customers with small batches could have 'their' grain dehulled on the spot and kept separate from other people's.

True to its name, RIIC is a rural operation, based in the large village of Kanye on the edge of the Kalahari Desert in Southeastern Botswana. In the Centre's workshops and offices, engineers and technicians prepare diagrams, build models, manufacture parts, and experiment with new materials. A variety of technologies are under development here: animal-drawn water pumps, windpumps, solar desalinators, farm carts and trailers, biogas plants. And, of course, dehullers. At the same time, young Botswana are being trained in breadmaking, carpentry, tanning, metalworking, milling, and other trades.

As a backdrop to this daily bustle is the continuous hum of the dehuller and hammer mill run by RIIC as a commercial venture to defray operational costs. Local women bring in 10 kilograms of their sorghum at a time to be dehulled and ground into flour for a small fee. The mill can also handle large shipments of sorghum.

With IDRC and other funding, the PRL dehuller went through a relatively quick metamorphosis at RIIC. In addition to modifying the machine to handle either small batches or a continuous flow of grain, the engineers strengthened, lightened, and simplified it. For example, a small platform for holding a container under the grain outlet proved to be unnecessary and was therefore eliminated. This not only cut production costs and manufacturing time, but made it easier to crate the dehullers for transport.

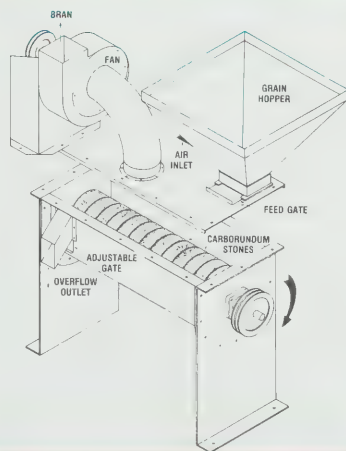
The machine's appearance was also spruced up, a problem of leaking bran corrected, and the bearing housing improved. An operator's manual was also produced in English and Setswana and RIIC was able to provide the necessary performance information to help entrepreneurs get credit to set up sorghum mills.

In the past few years, two major developments have been the transfer of the manufacturing technology to the private sector and the appearance of an export market. Two local companies now build dehullers under the guidance of RIIC which continues to be responsible for marketing and servicing. RIIC also exports dehullers to about 10 other African

countries including, ironically, South Africa which is normally the supplier in its trade with poorer neighbours.

By 1986, 25 small-scale mills (each comprising an engine, one or more dehullers, and a hammer mill) were in operation throughout Botswana, providing about 200 jobs. A small-scale sorghum milling industry is thus now in place, covering the populous eastern region. It even has its own national association to share information and to look after its interests, especially in regard to government pricing and grain supply policies.

Although the industry is well established, factors such as government policies, the 1981-85 drought, and competition from wealthy mill owners who are well supplied with grain have changed its complexion, clouding the prospects for small rural service mills. The dehuller-mill package was originally conceived by RIIC fundamentally as a rural service operation, that is, catering to farmers with small batches of homegrown grain. A number of mills, however, now operate as commercial factories, handling bulk loads of several tonnes, and the three



largest operations now control about two-thirds of the sorghum flour market.

Although the future seems uncertain for the largely idle rural service mills, government plans to grow more sorghum in the north may create the opportunity to harness the country's excess milling capacity.

On the brighter side, sorghum has been given a more secure home market in Botswana and many rural women no longer have to spend tedious hours dehulling by hand. According to Rural Industries Promotions' 1986 Report, a substantial proportion of that time-saving "is put into new productive activities". Perhaps as important has been the creation of a pool of indigenous knowledge and technical expertise.

The success of the dehuller in Botswana has not gone unnoticed in the rest of Africa. RIIC has helped to train researchers from Kenya, Malawi, Senegal, Tanzania, Uganda, and Zimbabwe in the initial stages of their dehuller-adaptation work.

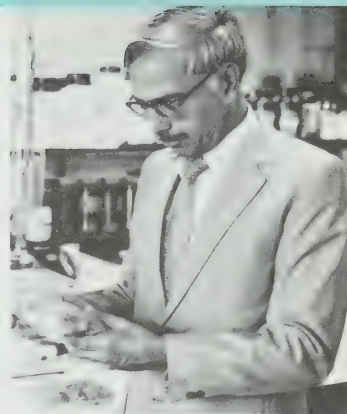
In Zimbabwe, the local branch of an African nongovernment organization known as ENDA has launched a four-year nation-wide project to develop and disseminate dehuller technology in that country. It is being conducted in cooperation with the Ministry of Agriculture. Preparatory work was supported by IDRC.

The project goals are to ensure that local metalworking companies are able to build the dehullers, to have 40 milling systems installed throughout the country, and to set up a credit system so that operators can buy equipment. The four-year project will receive more than \$3.5 million from the Canadian International Development Agency.

The Botswana experience, as well as lessons learned by another Zimbabwean nongovernment organization from an earlier mill installation, pointed out the importance of matching the dehuller's size to local population patterns and demand. In Zimbabwe, where the rural population is more dispersed than in Botswana, ENDA investigations made it clear that a relatively small dehuller would be needed. ENDA therefore lengthened the barrel of the PRL mini-dehuller and added a trap door to handle small batches. The result is a locally made machine smaller than the RIIC model but larger than the one used in the Gambia. It is currently being tested in five locations and IDRC is optimistic about the future of the technology in Zimbabwe's food system. ■

Ozzie Schmidt is a program officer in IDRC's Agriculture, Food and Nutrition Sciences Division. Based in Nairobi, he has been closely involved with dehuller development for over a decade and was Technical Director of RIIC in Botswana from 1978-1980

BEEFING UP THE PAKISTANI DIET



ART HOLBROOK

In the Hindu culture of India, cattle are regarded as sacred. They are not killed or eaten though their milk is used. Four decades after the partition of Pakistan from India, this Hindu tradition still influences perceptions in the Islamic state of Pakistan.

Despite there being no strictures against the eating of beef in the Koran, even today beef is regarded as a second-class meat in Pakistan. Beef, at 18 rupees (CA\$2) per kilogram, costs half as much as mutton.

Despite tradition, and with this price advantage very much in mind, Hamid Ahmad has chosen beef for his studies on the production, processing, and storage of dried meat products. Mr Hamid is the head of the IDRC-supported Meat Processing Project of the Pakistan Council for Scientific and Industrial Research (PCSIR) in Lahore. His research team has concentrated on the development of products based on traditional Pakistani foods.

The product they are most hopeful about is based on "barian", a food traditionally made mainly with pulses (edible seeds of leguminous plants). Because of rising costs and hygiene problems, the practice of using mutton in barian is not as common as it once was. By incorporating beef into the barian, the protein content of this widely used food product is

greatly enhanced. The PCSIR team has also developed other products including a dried beef mince which can be incorporated into spiced meatballs, and all-beef sausages.

Most Western "all-beef" sausages include a little pork fat to enhance their consistency. Since Islam forbids the eating of pork, a truly all-beef sausage requires a new formula. The use of a higher beef fat content to compensate for the absence of pork fat has, unfortunately, led to difficulties in the drying and storage of the product. Mr Hamid's team is now working on these problems.

Pakistan has a low average consumption of meat protein — only 10 to 12 kilograms per person per year. In the poorer areas of the country a large portion of that consumption takes place around the Muslim religious holiday of Eid-az-ha. At that time, every Muslim is enjoined to slaughter an animal and divide it into thirds. One third is for the sacrificer's household, one third is to be given to friends, and another third is for the poor. This overabundance of animal protein on a single day has led to the use of the leftover meat in barian and other foods at that time and, where there are no modern means of preservation, to considerable spoilage and waste.

Mr Hamid's meat processing research project complements longer-term efforts by the

Government of Pakistan to further develop beef production, especially through joint ventures with foreign investors.

Only about a third of Pakistanis have electricity, so refrigeration is not the answer. Mr Hamid's team has found that traditional sun drying, whereby meat is spread out on the ground, is ineffective. Even in the arid climate of much of Pakistan, the slowness of the sun drying process creates ideal conditions for insect infestation and spoilage. At the same time, much of the protein value of the meat is destroyed.

Going beyond simple open-air sun drying, the PCSIR researchers compared solar drying techniques (using improved equipment) with natural gas dryers. They found the gas dryers were more efficient and resulted in superior products. And fortunately, natural gas is abundant in Pakistan.

In the second stage of the project, now complete, the barian and other meat products were tested for nutritive value and microbiological quality using different rates of drying. With slower drying methods, up to 40 percent of the protein was lost, as compared with about 25 percent with rapid drying.

Since the completion of their work on drying techniques, Mr Hamid and his PCSIR team have begun shelf life studies of their meat products, and are investigating various kinds of plastic packaging. Their goal is a shelf life of six to eight months without deterioration of protein quality or spoilage. So far, the results are encouraging.

While the PCSIR team has been working on the technical aspects of the meat processing problem, an equally important study has been completed by the sociology department of the University of Punjab, also in Lahore. Mohammed Naim and a student research team conducted a survey of current meat processing techniques, marketing systems, and consumer attitudes in both rural and urban settings. They found that initial response to the new products developed by PCSIR has been positive.

Mr Hamid is seeking out manufacturers to demonstrate the products and their preparation. To date, the manufacturers who have come to look at the technology and products at PCSIR have been urban based. Many have expressed interest and are awaiting the final results of the project. Meanwhile, the researchers are exploring ways of extending their meat processing technology to the smaller-scale operations of rural communities. ■

Photos: Art Holbrook



Hamid Ahmad and Shagufda Nasreen test 'barian' sample for protein retention.

Art Holbrook is a freelance writer and communications consultant based in Ottawa

RATING BEANS

Photo: Luis Elias

ANNE FISHER

Eight men and women arrive at the laboratory of the department of foods and nutrition, ready to put their taste buds to serious work. Each panelist enters a private booth and is presented with "sample 1" — a small dish of cooked beans. Each places a bean between his or her molar teeth and bites down. The tongue is then used to push the inside of the bean against the roof of the mouth. Each person rates the sample's granularity on a scale of 1 to 10.

This kind of sensory testing is used by the food industry to test everything from cookies and ice cream to next year's breakfast cereal. But here at the University of Manitoba, in Winnipeg, Canada, Canadian and Guatemalan researchers are getting together to taste-test black beans from the hillsides of Guatemala.

It's not that Guatemalans are overly finicky. In fact, they have a real problem with their beans: they don't store well. After about five months, some become so hard that they have to be cooked for up to eight hours before they become soft enough to eat. The phenomenon is referred to by researchers as the "hard-to-cook" defect.

It was not as much of a problem in decades past when families grew their own food. In Guatemala and other parts of Central America, farmers have traditionally been able to grow at least two crops of beans a year and therefore did not need to store them for more than six months. But now Guatemala imports beans — from Chile, for example — and rural areas produce for the urban market. So not all the crop is sold and used within five or six months.

Hardening in storage affects an estimated 25 percent of the crop and throughout Central America is said to cause losses of about CA\$40 million. Since 80 percent of Guatemalan beans are grown by small farmers, and beans are a major source of protein in the Guatemalan diet, the hard-to-cook phenomenon affects ordinary Guatemalans every day. Consumers have to use more cooking fuel and end up with less nutritious beans.

IDRC therefore funded a study by researchers at the Central American Institute for Nutrition (INCAP) which is in Guatemala City. Their work led them to examine hard-to-cook beans stored in clay pots in farm kitchens, in burlap bags in storage sheds, and in government warehouses.

High temperature and humidity make beans harden faster and no prestorage treatments of

How do you like your beans? Guatemalan consumers are surveyed about their preferences in taste, texture, and appearance.



the beans seem to make any difference. In view of such findings, the INCAP researchers are experimenting with industrial uses of hard beans, namely for producing bean flour and paste.

They are also comparing the rate at which different varieties, both traditional and new, harden during storage. This information is important to plant breeders who, until now, have not taken into account the problem of decreased cookability in their strain-selection work even though it is a major source of loss.

As well as knowing how fast a variety will harden, they need to know how hard is too hard for Guatemalan consumers. So, with some help from experienced bean testers from the University of Manitoba, INCAP went into 600 homes and watched people cook their beans.

They found out how Guatemalans select raw beans at the market and how they like them to turn out after cooking. The rationale is that you cannot breed a better bean unless you know what a better bean feels and tastes like — and only consumers can tell you that.

But plant breeders cannot conduct a full-scale survey of consumer acceptability for each bean

cultivar. It is simply too time-consuming. They need to be able to test hardness as judged by consumers quickly and easily in the lab.

The INCAP-University of Manitoba survey told researchers the relative importance of various attributes such as raw bean colour and hardness, spreadability of cooked beans, and thickness and flavour of the broth. Most consumers want to buy black shiny beans that dent when bitten and cook to make a thick brown broth or smooth puree. With this information, a trained sensory panel can rate each characteristic for a given bean sample.

The mouth is not normally thought of as a precise scientific tool of measurement. But Dr Beverly Watts, head of the University of Manitoba research team, says that a trained sensory panel can "accurately reproduce consumer tastes in the laboratory". And some of that information can be used to calibrate machines to make these measurements — to simulate a Guatemalan family's tastes. ■

Anne Fisher is a Canadian freelance agriculture writer and cash crop farmer. She is based in Clarksburg, Ontario.

THE CHEMISTRY OF HARD BEANS

As part of the IDRC-supported bean network, researchers from the University of Guelph in Canada and the Catholic University of Chile (PUC) have been studying the biochemical mechanisms responsible for the hard-to-cook defect in beans.

It has long been known that the centres of hard-to-cook beans contain less phytate (a storage form of phosphorus) than normal beans. Storage at high temperature and humidity apparently causes a false germination reaction in which the enzyme phytase is activated and begins to break down the phytate.

The University of Guelph scientists, experimenting with Chilean black beans, were able to confirm the increased phytase and decreased phytate levels in beans stored in hot, humid conditions. They hypothesized that certain chemical properties of phytate promote the softening of beans during cooking. In effect, phytate helps to break down the intercellular 'cement' (known as the middle lamellae) which binds together the cells of the bean's centre. In hard-to-cook beans, the hypothesis goes, this breakdown is inhibited because of the reduced amount of phytate.

The second phase of the research has been looking at other possible hardening mechanisms including lignification (conversion of material into a wood-like substance). Work by the Guelph researchers indicates that in the latter months of bean storage the quantity of acidic compounds known as phenols decreases in the beans. They believe this is due to the transformation of the phenols (polymerization and oxidation) in a process of lignification by which the cell walls are toughened.

The researchers now believe that such lignification in the latter stages of bean storage plays a much greater role in the hard-to-cook defect than the reduction of phytate levels.

VALUE-ADDED FISH

Inexpensive and kids like it too... A survey revealed that school-children served by Chile's School Meal Service liked an experimental processed fish product developed by local researchers.



Neill McKee
IDRC

Developing Chile's fisheries is the business of the *Instituto de Fomento Pesquera* (IFOP). With IDRC support, researchers at the Institute conducted a fish processing research project from 1983–1985. Its central purpose was to help improve the socioeconomic situation of artisanal fishermen by setting up production centres to process small ocean fish species that are difficult to market fresh to the usual customers.

Among the potential consumers targeted from the start of the project was the national School Meal Service, which supplies about 600 000 servings a day to children.

Intermediate low-cost products were developed on a pilot scale. The required investment was within the means of the artisanal sector and the prices were right for the school meal market.

Fish pulp most popular

Scad, Spanish sardine, and mackerel were the species used. The products were preserved by being heavily salted and then dried under heat or else pressed (with or without an acid treatment). They were prepared in three different forms: pieces, sticks, and pulp.

The product that proved to be the most attractive, both to producers and consumers, was pulp — meat broken into small pieces, without bones or skin, salted and pressed. Quick, easy, and inexpensive to produce, fish pulp is also a versatile product that is easy to handle and remains stable at room tempera-

ture without any other kind of preservative.

The researchers separated the meat mechanically from the skin and bones and then treated it with fine salt (33 percent by weight). The brine was then extracted by pressing which reduced the moisture content to 45 percent or less, at which level the product could be stored at room temperature. Extracting the brine also helped to eliminate pigments and undesirable compounds that could adversely affect the quality and shelf life of the product.

The fish pulp was then covered with a layer of salt, hermetically sealed in plastic, and stored at 18 to 20°C.

Storage tests

For the first three to four months of storage, the quality showed no sign of deterioration. After the fourth month, the fish became moderately sour, dry, and hard, because the protein suffered a loss in its water-retention capacity. In the sixth month of storage, the product was evaluated for taste, texture, appearance, and smell, and rated as close to the limit of acceptability.

Microbiological tests showed that the high salt content (24 percent) and intermediate moisture level of the product (50 percent) inhibited the development of micro-organisms, restricting them to very low levels for the six months of storage.

Variations of traditional dishes

To evaluate how versatile and practical the product was, the researchers developed variations of traditional dishes and of canned preparations, both of which formats are being used

in the national school meal program.

Among the canned dishes were vegetable and fishball soup and other typical dishes in which regular meat was replaced by fish pulp and combined with vegetables.

Results of the acceptability tests done on schoolchildren showed that 70 percent enjoyed the food and 21 percent liked it somewhat. Only 9 percent found it disagreeable. The survey was based on 100 000 servings given to boys and girls ranging in age from 6 to 19.

The project has evidently succeeded in identifying and developing a fish product that is simple and inexpensive to produce and remains stable at room temperature for six months. As such, this food could well be useful in rural and other low-income markets where no cold storage is available.

On the technical side, it was shown that it is possible to prepare the product in an artisanal centre. However, the skills and level of interest of the fishermen themselves and their families in taking on this additional task were a limiting factor in the project. Although the processing technique was designed to suit the living and working conditions of the fishermen, and although their children operated the process easily and a ready market existed for the product, the researchers have not been successful in convincing them to take advantage of the opportunity. ■

This article was prepared by Stella de Feferbaum, regional liaison officer for IDRC's Communications Division, based in Bogota, Colombia. It is based on a project summary by César Varela and Raúl Toro of IFOP.

SUN AND SOFTWARE

SIERRA LEONE'S SOLAR RICE DRYER

JOHN EBERLEE

Rice is the staple crop of Sierra Leone, with about one third of the population growing a total of 275 000 tonnes every year.

But this isn't enough to go around. Sierra Leone still must import rice to meet everyone's needs. One reason is that a large percentage of the local harvest spoils or is otherwise lost.

Some of the loss occurs during drying. Farmers dry their paddy (unmilled rice) on the ground or on posts in the open air where birds, insects, and rodents can get at it. Losses as high as 10 percent may occur during drying.

Researchers at Queen's University in Ontario, Canada, may have found a way to avoid these losses. Their solution lies in the marriage of high-technology know-how and a low-technology device. Using computer-modelling techniques, they have designed a "natural convection" solar rice dryer that works as fast as ordinary open-air drying.

Solar dryer designs simulated

Such dryers are by no means a new idea. IDRC has sponsored several projects to build them in India, Southeast Asia, and several African countries. But few dryers, despite their success in cutting postproduction losses, have lived up to people's expectations. While it takes one to two days to dry rice in the sun, it takes at least twice as long with most solar dryers because of design flaws.

The IDRC-sponsored research at Queen's University is the first attempt to evaluate systematically how natural convection solar dryers work, and why some designs don't work well. Rather than build hundreds of different prototypes and then test each one over a long period in the field — all at great expense — the researchers created one computer program to simulate, at low cost, hundreds of different designs.

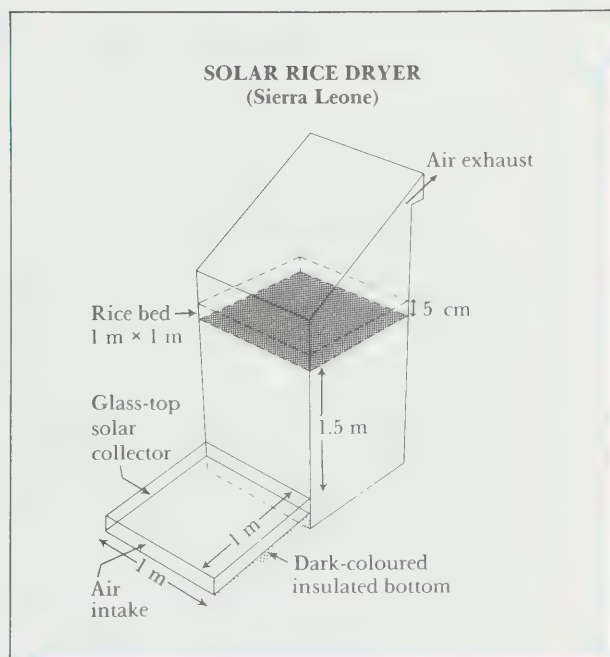
Dr Patrick H. Oosthuizen, Professor of Mechanical Engineering, and his graduate student, Alpha Sherrif from Sierra Leone, were able to pinpoint a number of design "rules" that guarantee satisfactory performance in dryers.

In natural convection solar dryers, the sun's radiation is the energy source. No mechanical device is necessary to pump air past the bed of rice. Rather, the air, heated by solar energy, rises naturally by "convection". In so doing, it collects moisture from the rice bed and deposits it outside.

Chimney not useful

Dr Oosthuizen and Mr Sherrif found that the chimney on old designs served no useful purpose. It cut down on performance by cooling the dryer and providing access to birds and

If a few simple design rules are followed, solar dryers can be built to work efficiently. The rice dryer design at the right could probably be built for around US\$75.



insects. The new design has a simple wooden lid, and a small rear grating to let moist air out.

Crucial to a dryer's performance is the height of the rice bed above the solar collector. Earlier designs had these too close together. In the new design, the bed is ideally about 1.5 metres above the collector.

Also critical are the depth of the rice on the bed and the area of the collector relative to the bed's. The depth of the rice bed, it was found, should not exceed 5 centimetres. If it does, the rice may not dry uniformly and could overheat and crack. In countries near the equator, such as Sierra Leone (7-10 degrees North latitude), the area of the collector should be the same as the area of the rice bed. Farther from the equator, where solar energy is less intense, the collector should be proportionately larger. This "rule" can change, depending on a country's geography and climate.

Dr Oosthuizen says any size of dryer can be constructed, for any size of operation, provided the design rules are followed. Small farms, say one hectare in size, need dryers with at least one square metre of rice bed. Such a device could handle a load of 30 to 40 kilograms at one time, taking about two days to dry it.

A dryer of this size could probably be built for US\$75 or less. Mud brick would be the principal construction material. Dr Oosthuizen

says the collector should be made of inexpensive glass, not plastic, because glass has a longer operational life.

Solar dryers among top priorities

As part of the overall project, a new dryer design is now being field-tested by researchers at the University of Sierra Leone and the Rice Research Station in Sierra Leone. Dr Oosthuizen expects few problems in distribution of the technology, which may begin in a few years. Dr Michael Bassey, an IDRC program officer now based in Senegal and the leader of an earlier phase of the solar dryer research in Sierra Leone, has surveyed the needs of rice growers and reports that solar dryers are near the top of their list.

Dr Oosthuizen may some day modify his computer program to design dryers for fish, fruit, and other grain crops. He emphasizes that the design process can be successful only if it remains a cooperative process. Third world farmers will always be the best sources of information on what problems to solve and what materials to use. The computer is simply a tool that makes finding the solutions easier. ■

John Eberlee is a freelance science writer living in Ottawa.

TOGO'S MAIZE BUGS ARE IN FOR A BIG SURPRISE



Traditional Kadelin maize granary in Togo. A small fire is periodically built underneath; the smoke reduces insect infestation.

SOULEYMANE OUATTARA

Follow a dozen recommendations. That's all Togolese farmers need to do to substantially cut the amount of maize they lose each year during storage, according to researchers at the University of Benin, in Togo.

The recommendations, which should make small-scale grain producers happy, were for-

mulated by a multidisciplinary team from the university's Graduate School of Agronomy. Without having to invest any extra money or change the structure of their granaries, say the researchers, farmers can store their maize cobs for several months without excessive losses because of hungry insects.

There is nothing miraculous in achieving such results. All that is needed is for farmers

to understand better how maize ripens in the fields, to adopt some specific cropping methods, and to follow a few simple rules when putting the harvest into storage.

The enemies of maize

Maize is the most popular cereal in Togo and is grown mainly in the south. Small farmers cultivate it both as a subsistence food and as a source of income. More than a third of the harvest is sometimes lost during storage for lack of proper granaries. Farmers therefore tend to grow only small crops, resulting in shortages in the national market and continuous price hikes.

The main culprits behind in-storage losses are parasites. "Primary" parasites such as weevils and lesser grain borers do the worst damage; "secondary" parasites attack only those cobs already damaged by the primary pests.

Most kinds of cereal are vulnerable to attack by weevils. In the case of maize, these beetles make holes in the kernels and often destroy the endosperm (the nutritious inner section of the kernel used to make flour), even though the husk remains intact.

As for the lesser grain borer, the damage it does to maize is probably even worse than that of the weevil. Its signature is little heaps of light yellow flour around the affected cobs. The damage it does inside is extensive and not a single kernel is spared.

Weevils and lesser grain borers get into the maize while it is still in the fields. At harvest time, they are carried from the field to the granary where they are able to pursue their destructive feasting undisturbed.

Until the University of Benin research team focused on the problem, the only suggestions had been to build silos and use insecticides — two solutions beyond the financial reach of small producers. "That's why we thought it would be better to reduce the infestation itself rather than treat it," explains Mrs Homa Smith, the entomologist who led the research team.

With IDRC's financial support, the team studied a number of factors: farmers' cropping and harvesting techniques, the kinds of granaries in use, products used for preservation, how much of the crop was lost, and the reasons for the loss. It was the first time traditional Togolese storage methods had been studied in depth.

The researchers selected two types of maize granary for close examination. Made of branches and straw, both designs were already in use in the south where the hot, humid climate is ideal for insect proliferation.

The first, the "Kadelin" type, is particularly promising. It consists of a wooden platform

Most kinds of cereal crops, especially maize, are vulnerable to attack by weevils. Far right, another traditional Togolese structure for storing maize, similar to the Kadelin.



Photo: Neill McKee / IDRC



Photo: Souleymane Ouattara

raised on four columns, thereby allowing a fire to be built on the ground below to smoke the maize. Cobs are carefully arranged in layers on the platform. To keep the layers from moving, the cobs are bundled in groups of five. A straw roof, barely higher than the top layer of cobs, is theoretically supposed to shelter the stored maize from the elements; in reality, it is the husk of each maize cob that performs this protective function.

The advantage of the Kadelin granary is the fact that it is 2 metres off the ground — high enough so that its contents can be smoked without risk of being burned. Additionally, the smooth surface of the bamboo used for the columns prevents small rodents from getting at the cobs. Unfortunately, this advantage is diminished because the bamboo, being in contact with the soil, tends to rot.

The second granary, the “Ebliva” type, is a cone with the point toward the ground, held up by four or more columns, depending on the diameter of the structure. The bottom of the cone is 40 to 80 centimetres above the ground. Cobs are bulk-loaded level with the opening of the cone. Then, rows of cobs are carefully laid on top of the loose cobs, up to the round thatched roof. In this type of granary, freely circulating air keeps the contents of the granary dry, thereby discouraging the proliferation of insects.

Farmers generally store their maize for 9 or 10 months. In so doing, they are protecting themselves against the possibility of poor harvests due to bad weather and other factors. Alternatively, they may simply be speculating on the eventual resale price of their crop.

Apart from smoke, farmers apply various natural substances to the maize to prolong the period of safe storage. In particular, the researchers noted the following: crushed neem leaves, palm wine distillate known as “sodabi”, activated carbon, and a variety of mixtures of the above substances.

Farmers’ know-how

The researchers were fully aware of the mistrust that farmers sometimes exhibit towards outsiders promoting new methods. They therefore wanted to work directly with the farmers right from the start of the project. Indeed, the first phase of the work took place entirely in the rural areas in collaboration with the 23 owners of the granaries under study. After that, a seminar was organized. It was attended by 44 farmers from 22 villages and provided valuable information.

“It was after the seminar that we decided that the researchers ought to take advantage of the

farmers’ knowledge,” says Mrs Smith. Her husband, an agricultural engineer, agrees, adding that it is the farmers who are the foremost experts because they are the ones who are most interested. “They have adapted their methods according to the resources available to them. They may not have any scientific training, but they are excellent observers.”

In the second part of the project, the researchers verified their conclusions experimentally. “Taking all the parameters into account,” explains Mr Kwami Kpakoté, an agronomist-engineer who heads the Graduate School of Agronomy, “we seeded three two-hectare fields. . . . These were in villages a great distance from each other.”

The researchers planted both local varieties and improved varieties — in some cases with fertilizer, in other cases without. They also decided it would be a good idea to try harvesting some of the experimental maize early and some later. They thus ended up with 24 different test cases, which enabled them to evaluate various combinations of relevant factors.

As regards storage, the most conclusive tests were those with the raised granary. Even if the smoking is only done every two weeks rather than daily, as tends to be the practice among the farmers, the losses are considerably lower than with the low-level granaries in which the insect population grew quickly.

Improved variety versus local variety

Cob infestation was observed to be worse for the improved maize variety than for the local variety. The reason is that the husks of the local

variety form a hermetic seal around the cobs, thus affording better protection. As a result, most farmers don’t want to plant the improved variety.

But the improved variety, particularly the hard type which keeps well, is a better bet because of its high yield, according to Mr Smith. “Besides, the surplus produced can bring in extra money.”

The effect of applying fertilizer was to double the yield of the local variety. Although the farmers dislike using fertilizer partly because of the cost, it would give them more resistant plants, less subject to insect attack in the field.

In the second part of the project, the farmers were informed of the effect of various factors on the storability of the maize. In turn, they passed on their comments to the researchers. The researchers then drew conclusions about the efficiency of the traditional storage system and drew up a set of recommended measures covering the whole process, from planting to storage (see box). Failing to follow any one of the recommendations could, of course, adversely affect the final result.

The researchers are currently doing more tests in the fields of 16 farmers to confirm the research results. Any necessary adjustments will then be made. Lastly, a second project is being considered as a way of disseminating the results of the first to farmers through the media and extension workers. ■

Souleymane Ouattara writes for the French-language African magazine Famille et Développement, in Lomé, Togo, and is a member of its editorial committee.

HINTS FOR STORING MAIZE

- Select a suitable maize variety, preferably the improved, hard variety.
- Plant on the recommended date so that the crop doesn’t have to be harvested during the rainy season.
- Weed properly, two or three times.
- Harvest at exactly the right moment — as soon as the maize has ripened and begins to dry. When one or two cobs have fallen over, the crop can be harvested.
- After harvesting, sort out any infested cobs.
- Use a raised granary with daily smoking

or a low granary without smoking.

- Build the granary according to the prescribed dimensions.
- Use an effective substance to treat the stored maize (to be selected from what is locally available).
- Cover the granary so that it is protected against the rain but allows air to circulate.
- Install an anti-rodent guard.
- Locate granaries away from buildings.
- Maintain the granary area and keep it clean.

THE FRESHER, THE BETTER

LIFE IN THE LAKE VICTORIA FISHERY



Photos: Andrew R. Mowat

The people on the beach waited expectantly, eyes fixed on the small fishing boat with its single blue sail. As it approached the shore, they moved closer to the water, followed by barefoot children.

As the boat landed, the buyers jostled for front positions to have the first look — and the first chance — at the catch. No time was wasted. Within minutes the six large Nile perch were claimed and taken up the beach to be weighed and priced.

The scene is repeated hundreds of times a day on the many landing beaches on Lake Victoria, which straddles the borders of three East African countries: Kenya, Uganda, and Tanzania. It is marked with a sense of urgency and competition, as each catch is moved

quickly from the boats to the buyers, to the processing stage, or straight to market by foot, bicycle, bus or truck.

While the fishing industry accounted for only 0.2 percent of Kenya's Gross Domestic Product between 1971 and 1981, it is big business for the Luo and Luyia people of western Kenya who ply the waters of Lake Victoria. Indeed, it is the major economic activity as well as the prime source of protein for the six million inhabitants of Kenya's Lake Victoria basin. Fish harvesting, processing, and marketing employ almost half the working age population.

Other economic prospects are very limited. Rainfall is low, the soil is poor, agriculture is mainly at the subsistence level, and paying jobs are scarce. The area's major export has been people — to Nairobi, the capital, and to other cities.

Efforts to increase employment in the area and to improve the standard of living must focus on the fishing industry, says Dr Gilbert Ogutu, a Kenyan sociologist and University of Nairobi lecturer. He is hoping the IDRC-sponsored research he is conducting into the Lake Victoria fishery will point to ways of making the industry more productive, while ensuring that the benefits remain in the region.

Lake Victoria is one of Kenya's largest producer of fish. From the mid-1970s to 1981, its annual harvest increased from 17 000 to over 39 000 tonnes. The Kenyan government has set a 1988 production target of 50 000 tonnes, a substantial share of the national target of 120 000 tonnes.

Dr Ogutu grew up only a few kilometres from the lake. He has witnessed the increasing commercialization and modernization of fishing



Weighing the catch at Usenge Bay. Job creation in the area must focus on fishing, says sociologist Dr Gilbert Ogutu.



and the decline in certain fish species as new types were introduced to the lake. He has also observed the social effects of rapid population growth in the area and high unemployment among early school leavers, many of whom turned to the fishing industry for employment.

In his current research, Dr Ogutu hopes to discover how policymakers and people employed in fishing can best respond to the changes in the industry. The research focuses on the socioeconomic status of fishermen and fish traders, why they succeed or fail, their linkages to other parts of the economy, and marketing channels.

Since April 1985, Dr Ogutu and his assistants have studied four of the Kenyan fishing districts, concentrating on 12 main landing beaches. They have used government records from 1984 and 1985, as well as their own observations and an extensive survey of 64 landing beaches and 52 markets.

Profits not shared fairly

The research has underscored one of Dr Ogutu's prime concerns — that the people who carry out the bulk of the work in fish harvesting and processing do not receive an adequate share of the profits.

A typical fisherman is a young married man between the ages of 21 and 35, most likely with only a primary school education. More than half work as hired labourers and only 12 percent own their own boats.

While their average monthly income is quite high by local standards — as much as 1500 Kenyan shillings or US\$92 — the bulk of profits go to the people who own the boats and fishing gear.

Of the total day's catch from each boat, only 10 percent is paid to the labourers, usually divided up among four men per boat. The Ministry of Fisheries and the local fishing cooperative take 10 percent between them, and another 10 percent covers the overhead. The remaining 70 percent is profit for what Dr Ogutu calls the "absentee owners" of the boats, many of whom live outside the region and have never set foot in a boat. "They (the owners) are exploiting these young men," says Dr Ogutu. He would like to see their relationship altered so that the income is distributed more equitably and local fishermen can purchase their own equipment.

Entering the industry as anything but a hired labourer is extremely difficult for local men. A boat costs from 6500 to 8500 shillings (US\$406 to \$531), and seines, gill nets, and other equipment may total 15 000 shillings (US\$938).

While it may be feasible to increase the Lake Victoria catch, under the present structure this would simply increase profits for the boat owners, says Dr Ogutu. He is therefore looking for ways fishermen can increase their incomes by moving into the marketing of fish.

At present, the fishermen's job ends once the catch is handed over to the buyer. The buyer

may then send the fresh fish directly to market by public transport or, in the case of larger retailers, in refrigerated trucks which take the fish as far as Nairobi, 340 kilometres away. However, most of the fish is sold and consumed within western Kenya. Because of the short shelf life of fresh fish, almost 60 percent of the catch is processed before marketing.

Since first introduced into the lake in the 1960s, Nile perch have increased rapidly and by 1984 represented more than half the catch at the 10 landing beaches in Dr Ogutu's study. Meanwhile tilapia, previously the dominant species, have dwindled alarmingly.

Although there is a great deal of controversy over who is responsible for the shift in the fish population, Dr Ogutu chooses not to dwell upon the issue. "The lake is not depleted of fish," he reasons. The important question for him is: "How can the dominant species (perch) be exploited for the benefit of the local fishermen and fish traders?"

Consumers prefer tilapia

Answering the question requires consideration of a wide range of issues, from nutrition to cooking habits and processing techniques. Local tastes still favour tilapia, despite the abundance of perch. Many people find the latter too oily. The price difference reflects this preference: the price of tilapia at the beach is three times that of perch. One of Dr Ogutu's goals is to find better processing and cooking methods for perch, to increase its appeal and value.

It is the fish traders who do the processing and Dr Ogutu and his research assistants have studied this segment of the industry in detail. In a sample group of 250 traders, they found 74 percent were women, most of them married, with between 3 and 10 children. Some women travel more than 65 kilometres from their homes to the landing beaches. More than half of the traders sampled spend two to five days per week living at the landing beach, processing the fish they buy, returning to their homes and families for the rest of the week. This pattern has led to the formation of loosely knit communities of women and children on the beaches.

One such community is at Uhanya Bay on the northeast end of the Kenyan shore. It is a ramshackle collection of one-room homes with mud walls, some of them with corrugated iron roofs, others with thatched roofing. Scattered between the homes are smoking kilns constructed of mud and sticks. Throughout the small community, fish are continuously being deep-fried, roasted, spread out to dry in the sun, or filleted.

At its peak, the population at Uhanya Bay reaches 1000, including about 100 children, many of them of nursery school age. Yet the nearest school is four kilometres away.

Some of Dr Ogutu's recommendations will address the inadequacy of facilities in such communities. He is also concerned about the

social damage caused by the separation of family members as well as the economic difficulties associated with a risky business such as fish trading.

Since most women rely on local transportation to get the fish to market, a bus breakdown or a flat tire on a bicycle could cause her to lose her entire load of fish. "Is there any way to improve the processing and make the transportation system cheaper but more reliable, so that the spoilage is kept to a minimum?" asks Dr Ogutu.

Improved processing techniques will increase both the shelf life and the value of the various fish products. Longer shelf life in turn allows market expansion. With fresh fish, each hour gained through improved preservation expands the immediate market radius by 50 kilometres or a minimum of 200 000 potential consumers, according to research findings.

Unhygienic conditions

The type and quality of processing vary widely from beach to beach. Although some traders make an effort to keep their fish clean, "the unhygienic conditions drastically reduce the shelf life of most species of fish."

Through education and by sharing his research findings with the local people, Dr Ogutu hopes to see an improvement in the handling of fish from the moment they are caught until they are consumed. This will expand the markets, increase economic value and nutritional levels, and bolster the fish traders' incomes.

Dr Ogutu would also like to build a model landing beach for demonstration purposes. It would have improved facilities such as raised platforms for drying and smoking fish.

Boosting local incomes by improving fishing and related operations can only have an overall positive effect on the region because of the industry's importance to so many people, says Dr Ogutu. For, in his words, "all the circulating currency notes in the region smell of fish." ■

Andrea Prazmowski is an Ottawa-based freelance writer currently travelling in Eastern and Southern Africa.

AFTER THE HARVEST

ED WEBER

Photo Denis Marchand



This page, clockwise from top: Traditional grain storage in Flaboula, southern Mali; selling hot fish balls on a city street in the Philippines; dehulling millet with a mortar and pestle in Mali; smoking fish in Guyana. Page 15: mechanical processing of millet in the Gambia using a mini-dehuller; canning bamboo shoots in China; salting fish in a plant in Guyana; emergency food being unloaded in Ethiopia; fresh produce at a market in Nepal.



Photo: Neill McKee / IDRC

Soon after harvest, food products begin to deteriorate in one way or another. Insects attack, bacteria proliferate, moulds grow, and biochemical changes occur.

These destructive processes can be eliminated or at least slowed down by controlling the environment in which they would otherwise flourish. What is usually needed is some kind of treatment to render the food biologically stable. This is true for grains, legumes, roots and tubers, fruits, vegetables, oilseeds, fish, shellfish, milk and meat — the staple foods of the human race.

In most of the industrialized countries, the postharvest food industries — including storage, processing, preservation, packaging, and marketing — employ many more people than basic food production. In much of the developing world, the pattern is reversed, with most of the population engaged in growing crops, raising animals, fishing, and so on.

Numerous ingenious methods for preserving food have been invented and used over the centuries. Sun drying, fermentation, pickling, and salting are some of the more common ones. To these, modern technology has added refrigeration, freezing, hermetic sealing, irradiation and a variety of other processing techniques.

In the Third World, much of the processing and handling of food still occurs in rural areas, close to where it was grown. Although some of this food is for home consumption, an increasing proportion is for sale to the ever-growing urban populations. As a result, there is a growing need for postharvest services. If properly organized, these can provide much needed jobs and income.

IDRC's Post-Production Systems program supports research into all aspects of food from the time it is harvested until it is eaten. This means much more than simply looking for ways to cut food losses after the harvest. It also means examining other crucial food-related issues such as distribution, sales (on the street and in shops, markets, and restaurants), nutrition, access to food, food security, and job creation, especially for rural people.

From the farmer's field to the consumer, the handling, processing, and distribution of food can be important elements in a country's or region's economic development. In 1985, food industries accounted for at least 20 percent of all manufacturing activities in developing countries.

Such an important sector poses major development choices. For example, how big should

Photo Denis Marchand



Photo: Claude Dupuis

food processing and distribution systems be and what kind of technology should they use? Large centralized operations may benefit only people who are well-off without creating many jobs. On the other hand, replicating smaller traditional systems may not be the answer either because of growing or changing food demand and built-in inefficiencies.

A good starting point in the search for answers is to improve what is already familiar to people. The quality and nutrition of traditional foods can be improved, as can the productivity and efficiency of time-honoured processing techniques. There are also possibilities for linking small enterprises which do only part of the processing or distribution with the operations of larger centralized enterprises.

In the final analysis, the task of developing country researchers working in postproduction technology is to ensure an adequate supply of nutritious food as well as access to it by all members of society, both rural and urban. ■

Ed Weber is Associate Director, Post-Production Systems, in IDRC's Agriculture, Food, and Nutrition Sciences Division.



Photo: Denis Marchand



Photo: Denis Sing / IDRC



Photo: Neill McKee / IDRC



Photo: IDRC



CIDA Photo: David Barbour

SCIENCE AND THE PRINTED WORD

TRAINING FOR THIRD WORLD EDITORS



The inner workings of an offset press are explained to an international group of EDPUB trainees in the Philippines. Above, Ian Montagnes, EDPUB project leader.

IAN MONTAGNES

On the Indonesian island of Java, a centre devoted to information about weeds and weed control has started a newsletter. In Tanzania, a research publisher has a new catalogue.

In Papua New Guinea, farmers are learning how to grow rubber for profit with a simple, new booklet as their guide. In a dozen other countries, from Barbados to Bangladesh, research institutes have new publications describing their work.

All these booklets, pamphlets, and newsletters were produced by Third World editors as they attended the Editing and Publications Course — EDPUB for short — based in the Philippines.

There are 10 trainees per session. In 14 intensive weeks, they explore the techniques of clear writing, careful editing, effective design, and economical production of printed materials. They learn about promotion and distribution, photography and audiovisual presentation.

One group of trainees designed a T-shirt to summarize the main lessons they learned. Emblazoned on the shirts was KIS III: "Keep it Simple. Make it Interesting".

The project was designed to bridge a major communications gap. Good research is being done in the Third World but too little of it reaches the extension and health workers, teachers, and farmers who can transform that new knowledge into fuller bellies and fitter bodies.

One reason for this is the shortage of men and women skilled in scientific reporting techniques and the art of interpreting and simplifying research results for a broader public. The Third World needs more editors.

Places in the EDPUB course are few and competition for them has grown increasingly stiff. But now the course is taking root elsewhere. Its teaching materials are being translated into Chinese and Kiswahili, for example. Its creators hope that during 1988, when the three-year project is complete, its approach will be available worldwide.

Three organizations have joined forces to bridge this gap. IDRC provides the major financial support. The International Rice Research Institute (IRRI) near Manila is the project's home, providing participants with typesetting, printing, photography, and audiovisual facilities. The University of Toronto Press has loaned my services for three years to lead the project, develop the curriculum, and do much of the teaching. The Press has also contributed books and the time of other staff members with design expertise.

The first course started in April of 1985. The fifth session began in July of this year.

Many of the trainees are editors with two or more years' experience, seeking professional development. Others need training for editorial responsibilities they have only recently been given. Most work for agricultural or health research institutes.

Each trainee brings a manuscript from home.

During the course they reorganize it, edit it for readability, plan a design, choose or create illustrations, and prepare the manuscript for the printer. They proofread the typeset text, lay out pages, and approve the final material for printing. On the final day they carry off all the final artwork components (the "camera-ready") that will enable them to print more at home.

Outside the classroom lectures, technical staff from IRRI teach them how to develop and print photographs, how to superimpose colours and titles on slides, and how to draw high-quality graphs. They demonstrate platemaking and binding, and show the trainees the inner workings of the printing presses. And IRRI editors offer individual counselling.

The handouts, exercises, and supplementary readings prepared for the course now fill six binders. With them, graduates of the course should be able to tackle most editorial problems back home. Remarkd a young Indonesian at the end of the course: "I used to edit by instinct. Now I do it by logic."

The teaching materials will probably be published at the end of the project so that national and regional organizations can translate and adapt them to local needs. The handouts and exercises are modularized so that courses of one, two, or more weeks can be tailored to specific needs.

The first such course took place in November 1986 at the Central Research Institute for Food Crops in Indonesia. The course was based on EDPUB approaches and materials and was run by program graduates. IDRC funded that experiment.

At the end of 14 weeks, most of the trainees say they are returning to work with greater professionalism and increased confidence. In the past, most have had little opportunity for professional development and most have felt low in the pecking order — unable to question a scientist-author about any part of a manuscript.

"I used to accept the author's tables and illustrations as gospel truth," a Malaysian editor recalled. "Here I learned to edit and improve them. I have learned not to be awed by what the scientist has written. I understand the role of the editor."

"I now feel I can produce any publication — edit it, design it, and supervise its production — and do it independently," a Bangladeshi editor remarked.

A Barbadian researcher, recently turned editor, echoed those comments: "I feel I can go back and take any manuscript that has something in it. If I can't make it shine, I can at least make it readable." ■

Ian Montagnes is the project leader of the Editing and Publication Training Course at the International Rice Research Institute. He was seconded for the project from the University of Toronto Press where he is assistant director and editor-in-chief.

TUNISIA BREATHES A SIGH OF RELIEF

A recent study shows that pneumoconiosis — a disease caused by inhaling irritant particles day after day — isn't a serious problem among Tunisia's phosphate miners and plant workers. The sea of dust surrounding some of the mining towns and processing plants, however, remains a real nuisance.

HAMIDA BEN SALAH

“**Y**ou want to see dust, do you? I'll show you dust!” exclaimed the National Guard officer when questioned by Prof. Abdelaziz Ghachem, the Tunisian Ministry of Health's head of occupational medicine. “Come home with me, look at my linen, my bed, my fridge! There's dust all over the place!”

The air in the mining town of Redeyef, in the south of Tunisia, is so dusty that one can't really see the sky, only a vague glimmering through the gray clouds.

Prof. Ghachem, the director of the National Centre for Occupational Medicine and Ergonomics, heads a mission to verify the extent of the damage in the town. The problem is that an enriched-phosphate plant spews out effluents and is directly upwind of the town which has consequently become covered with a uniform layer of dust. “It's like living in a snowy climate. Around the plant you can sink into the dust up to your thighs,” reports Prof. Ghachem.

Redeyef is one of the 16 sites in Tunisia where phosphate is mined and enriched by the state-owned Gafsa Phosphate Company.

Phosphate is one of Tunisia's greatest underground sources of wealth. Reserves are estimated to last for a century. However, mining them has considerable adverse effects on the local population and on the approximately 12 500 people who work for the company.

As early as 1970, radiological studies of Gafsa miners had raised the possibility that some of the workers were suffering from pneumoconiosis, a lung disease caused by habitual inhalation of irritant dust particles. The biggest concern was silicosis, a form of pneumoconiosis caused by inhaling dust which contains large amounts of silica. Sufferers cough and spit and have difficulty breathing. The decline in the functioning of the lungs is often accompanied by heart problems.

But the risks and the composition of harmful dust had yet to be pinpointed. With a grant from IDRC and the cooperation of McGill University in Montreal, a team from the National Institute for Occupational Medicine and Ergonomics started an epidemiological study in 1984. The sample consisted of 942 Gafsa employees selected according to the mine they worked in, their job, age, and length of exposure. The survey was accompanied by an environmental study in which 1214 samples of dust were taken in the different mines, quarries, and factories of the company and in mining towns.

For the medical study, workers answered a questionnaire designed to assess their respira-

tory symptoms, exposure to dust, and professional background. They were also given a clinical examination which included lung X rays and lung capacity measurements.

The researchers are reassuring about the results. The clinical study indicates that in most cases, the pneumoconiosis is a benign form caused by inert dust. The team's lung specialist adds cautiously, however, that on a very few work sites, where there is a lot of silica in the dust, there are cases of silicosis. This form of pneumoconiosis doesn't seem to be very serious and it develops very slowly, the doctor says.

Of the 942 workers in the sample, only four of them will be entitled to financial compensation for permanent physical disability. It should be noted that all four have smoked for over 20 years.

Not that the environment is blameless. The dust which bothers the whole town and the workers especially is certainly a nuisance.

The dust levels in seven underground mines and six factories and quarries were measured. The results indicate that silica is present everywhere, but at low levels not exceeding 6 percent. And it appears that the miners who

work underground are less exposed than workers in the enrichment plants.

Mourad Chaker, the chemical engineer in charge of the environmental study, was trained in analytical methods at McGill University. His calculations show that wherever a mine or processing plant is mechanized, dust levels are higher. In particular, crushing operations produce dust which is rich in silica and, therefore, potentially harmful. According to the researchers, injecting water during drilling would substantially reduce the amount of dust.

The researchers noted that Tunisian mines are “never adequately ventilated, nor are they well built. In general, the broader the tunnel, the less the dust.” They observed the benefits of wide tunnels at Lalaa Khasha and the Séhib mine.

The researchers termed the study results “reassuring”. They were, however, agreed that a watch should be maintained in future. To this end, they are planning to recommend measures to control pollution and to protect workers in Tunisia's phosphate industry. ■

Hamida Ben Salah is a journalist with Agence Tunisie-Afrique-Presse.

Photo: CNMTE



No use waiting for the dust to settle. In Tunisia, Ministry of Health researchers visit a phosphate-enrichment plant.

Artisans of development

African villagers rely on local artisans to provide them with everything from watering cans to cookstoves. In Niger, the International Labour Office is training young artisans and helping them to launch small money-making enterprises.

MICHEL FROMONT

ILO photos



Issifou is squatting on the ground under the big shade tree in the family courtyard in the large village of Dogondoutchi, in southern Niger. A couple of paces away his sisters are dehulling millet with a pestle. Spread around him are a hammer, shears, pliers, an anvil, and a thick strip of steel which must once have been a truck spring. Next to these tools of his craft is his raw material — empty cans.

In less than two hours, using the shears, the hammer, and the pliers, he makes a watering can. He only needs to solder it in a couple of spots before it can be sold to people in the village. He will sell it for 2500 CFA francs, about one eighth of the price of the same item in the capital, Niamey, 400 kilometres away. It is an essential tool for growing vegetables in the dry season.

Dogondoutchi is one of four centres of operations of a project for training artisans and supporting their enterprises. The project was started in November 1985 by the International Labour Office (ILO) with financial support from the U.S. Agency for International Development.

The succession of droughts, particularly that of 1983–84, had a severe impact on this agricultural region, traditionally a millet granary. It made the farmers realize the need to diversify their crops and, despite their small incomes, to obtain the required tools: water pipes, sprinklers, and ploughing equipment.

At the same time, the government authorities and the aid organizations came to realize the futility of large, expensive projects administered from the cities, often ill-adapted to the real needs.

Assist established artisans

It was in this context that the ILO cooperative project began. The key words are adaptability, appropriateness, and realism. "We want to adapt to the local situations and by always having an expert or promoter on hand or available, respond to the immediate training needs of established artisans," explains Paolo Giglio, who is responsible for project operations.

The story of Issifou, like that of others, shows the wisdom of this new approach. He is 25 years old, intelligent, and skillful. If the training project had followed the usual route he probably wouldn't still be in his village. With the old pattern, a centre would have opened and

the most gifted young people would have been drained off from it into the cities, with or without a diploma in their possession.

In this case, things are quite different. Issifou's father trained him to be a tinsmith and he is now working at the hub of a service network which, step by step, is expanding and diversifying the skills of the region's artisans, and enhancing the value of their indispensable services.

Because of the project, Issifou will be able to enroll in a short course on how to repair and even make locally designed water pumps well suited to market gardening. And, as master of a craft not yet well known (making watering cans), he will be able to pass on his know-how to an artisan from a distant village whose inhabitants also want to start raising crops out of season.

Range of services at affordable prices

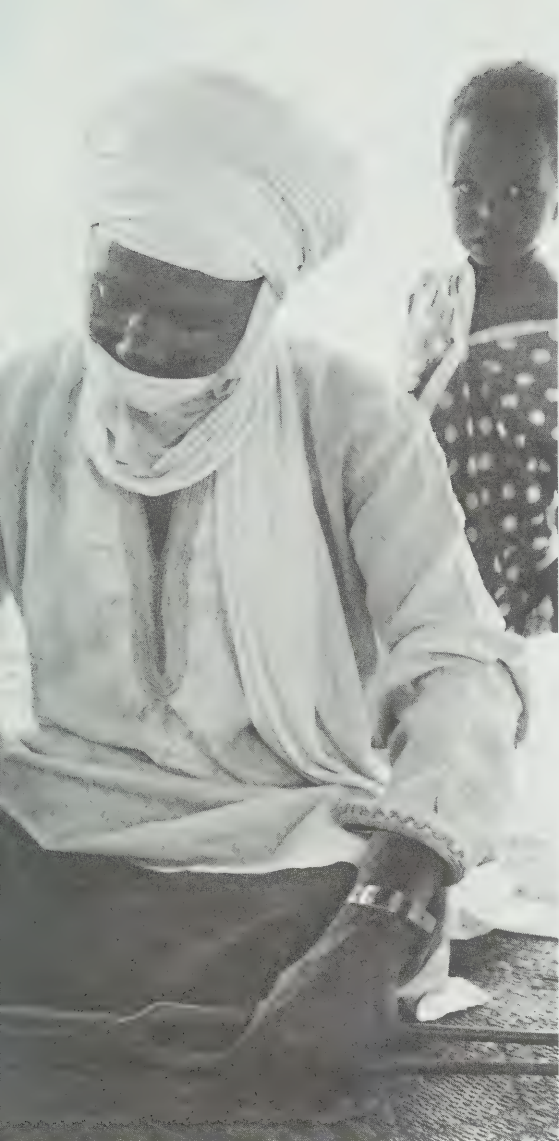
"My job is not to try to foster technologies here which are too complicated or burdensome," explains Jean-Louis Arrachart, promoter on the Dogondoutchi project. "Artisans should be able to supply as broad a range of services as possible at prices which are affordable but which also allow them to balance their own budgets. What I try to do is to give a helping hand here and there to keep things moving: transportation so someone can go on a course, or extra supplies if they're needed, or small loans to buy raw material, or advice on how to manage things."

Gabriel works on the same ILO project at another location, the village of Say, in the Niger Valley, about 60 kilometres from Niamey. "The problem is to get village economies unstuck," he says. "Nothing gets going because there isn't any financing available. We have to help get things into a state where new or improved technologies are proposed, recognized as useful by the people, and made readily available by the artisans themselves who are thus able to earn a living at their trade."

Take the case of Moussa, a blacksmith. Trained in the making of improved cookstoves, he won't be able to go on performing this service unless the project first helps him to buy the right tools and find customers.

Ali is an auto mechanic and his first attempt to set up business ended in bankruptcy. The ILO project gave him a second chance. Equip-

Ali, a garage owner in Say, Niger, is trained in business management under an ILO program.



Two artisans of Niger. Left, Moussa, a blacksmith, has learned to make an improved cookstove. Right, Issifou, a tinsmith, puts the final touches on a watering can.

ped with a welder and a small stock of raw materials, he took up repairing carts and a variety of agricultural implements. The promoter gave him some basic ideas about how to run his business and guided him in opening a bank account. The constant growth of his turnover enabled him to pay off his debt to the project bit by bit.

Promoting self-sufficiency

In less than a year, about 180 artisans were visited by experts and some 50 training activities were undertaken. Mr Giglio is now planning to set up a fund, initially with the financial support of the project, to guarantee loans to artisans so that they can improve their equipment and their supply of raw materials.

Collaboration is now developing between the ILO project and others with similar objectives, particularly an older one in the city of Tahoua further north. It provides the same sort of training from a central research workshop which makes agricultural equipment. The unit employs about 80 people full time and designs and markets a broad range of products suitable for use locally by farmers, either singly or collectively. These items include wire netting

used in building dykes, pumps that are simple to construct and repair, brick presses, millet and sorghum beaters, grain mills, ploughing equipment, and carts.

"Thanks to instructors trained in the workshop, we are organizing recycling courses for artisan-smiths in the villages," says Walter Spettel, who is in charge of project operations.

"The problem is to get village economies unstuck"

"This helps them to meet new needs. They make tools which used to be imported, equipment for off-season farming, and improved cookstoves. Since 1985, 24 village smiths have been trained, some of whom have decided to work cooperatively.

Mr Ziliotto, the ILO officer who started this

new approach to training in a village environment, sums up the philosophy behind it: "The objective is to integrate rural training into peasant life. The old-style teacher is replaced by a 'doer' who transforms everyone's knowledge into practical action. The classroom is replaced by fields and workshops; everyone learns by doing. The realities of market and earnings give the system its coherence and its place. Foreign assistance, which starts things rolling, is above all a state of mind, the presence of someone in the community whose job it is to understand problems and win confidence by talking with the people."

Mr Giglio adds: "A project like this isn't intended to last forever and become barnacled. We want it to end as quickly as possible — as soon as it has helped to set off a process leading to self-sufficiency." What he doesn't add is that this kind of work will have to be replicated by a hundred or a thousand times if the rural Sahel is ever to get out of its difficulties. ■

Michel Fromont works in the Public Information Office of the International Labour Office, in Geneva.

ICRAF: A DECADE OF AGROFORESTRY

DAVID SPURGEON

Photo: David Spurgeon



Tree nursery at Got-Osumbo Primary School in western Kenya where students learn about agroforestry. Top, a nursery operator with tree seedlings, in Machakos, a semi-arid area of Kenya.

In 1975 a study team led by the late John G. Bene, then senior advisor to the president of IDRC, published *Trees, Food and People*, which called for a new approach to agricultural and forestry problems of the Third World.

Thus began a chain of events that led to the formation, in 1977, of the International Council for Research in Agroforestry (ICRAF). In September, with the holding of a two-day conference in Nairobi featuring addresses by world leaders in agroforestry and attended by representatives of more than 100 organizations, ICRAF celebrated its 10th anniversary.

The conference, held in ICRAF's new headquarters building adjacent to the United Nations complex in Gigiri, just outside Nairobi, marked the coming of age of a new scientific discipline with prehistoric roots.

Agroforestry is the term used to describe agricultural systems in which shrubs and trees are grown together with food or plantation crops on the same piece of land, sometimes in association with livestock. Such systems can be highly productive and sustainable. They offer one solution to the problem posed by a recent report of the UN Food and Agriculture Organization which predicted that by 2000 A.D., assuming present levels of agricultural inputs, the developing world will contain 500 million

more persons than its land resources can support.

Shifting agriculture, perhaps the earliest form of agroforestry, is believed to have originated as early as the neolithic period, around 7000 B.C. In this practice, still found in many parts of the world, farmers clear forest areas to plant food crops, then after some time move on to repeat the process, leaving the forest to regenerate behind them. Yet, apart from research by some colonial governments in the tropics, it is only within the past decade or so that agroforestry has become the object of concentrated scientific study.

ICRAF has played a major role in this regard. It is, in fact, the only international research body devoted entirely to the field. Since its establishment, interest in agroforestry and support for it by international funding agencies and aid-giving countries has increased markedly. From 1977 to 1986, for example, lending for agroforestry projects by the four multilateral development banks increased from 6 percent to 37 percent of their total forestry investments.

ICRAF's funding comes from 15 donors, including governments, foundations, and development agencies. Canada has been among them from ICRAF's inception, both through IDRC and the Canadian International Development Agency. IDRC also served as the execu-

ting agency in establishing ICRAF.

ICRAF is an autonomous, nonprofit research council governed by an international board of trustees with equal representation from developed and developing countries. With the exception of a representative of the host country, Kenya, trustees are elected on individual merit, not as official delegates from countries or organizations.

What are the advantages of agroforestry for Third World farmers? Besides producing food crops, it supplies them with tree products such as fuelwood, fruits, and fodder. Trees can also be used to supply poles for fencing, while their leaves can be used for mulch. Their roots pump up nutrients from deep in the soil and, if they are leguminous, the trees themselves provide a source of soil nitrogen to fertilize the food crops.

Trees provide shade for animals while ground cover crops provide the animals with fodder. Meanwhile, the animals' droppings fertilize the fields they graze. Trees also may serve as windbreaks, and shrubs as living fences.

Numerous examples can be found of successful agroforestry practices in a variety of countries. Food crops such as cocoa in Malaysia, cassava in India, banana in Jamaica, and pineapple in the Philippines are intercropped with coconut trees. In arid and semi-arid areas, food crops such as millet are grown in association with leguminous trees.

In Malaysia, sheep, poultry, and bees are integrated into the rubber plantations of small landholders, in order to make use of surplus family labour and of the land spaces between the rubber trees. The practice also provides shade and cheap feed for the animals, which eat the weeds in the interspaces, while the sheep manure benefits the rubber trees.

ICRAF acts as a resource for countries wishing to improve their farmers' lot through the use of agroforestry techniques. It has developed a method dubbed "D & D" (diagnosis and design) to identify agroforestry potential in a given set of circumstances. It has also set up computerized banks containing information about multipurpose tree species.

The trial-and-error approach of farmers has taken centuries to bring agroforestry practices to their present state. ICRAF has existed for only one decade but in that short time has established an independent set of agroforestry principles and a specialized body of knowledge. These continue to develop and are bringing to more and more Third World farmers the concrete benefits of cultivating trees and crops together. ■

David Spurgeon is a Canadian science writer and a former director of IDRC's Communications Division.



Photo: Gerry Toomey IDRC

BEAUTIFUL, FUNCTIONAL RATTAN

MARK TIMM

Perhaps you're sitting in a rattan chair right now. Perhaps you got this magazine from a rack made of it. Rattan has become so popular over the past few decades that it has literally and figuratively become 'part of the furniture'.

You're not likely to trouble yourself much about the origins of this cane material — any more than you would about the origins of the wood in any other furniture.

But rattan may be threatened with extinction. Demand is so great that immature plants are being harvested before they can produce seeds. As a result, natural growing stocks of the plant are dwindling.

Rattan, a climbing cane plant, is a member of the palm family. There are 14 genera and 600 species growing throughout tropical Asia and West Africa. The longest reported specimen was a cane which grew to 168 metres in length.

Collecting rattan in the forest is unpleasant and dangerous work. The plant's barbed whips are a constant source of irritation and there is always the risk of dead tree branches falling on the harvesters' heads as they try to pull the rattan cane out of the tree canopy. As the cane is dragged down, the harvesters usually twist it around a tree trunk to remove any thorny leaf sheaths.

Once the canes have been cut into lengths and transported out of the forest, their outside layer is stripped off and they are left to dry for about a week. Further processing, such as washing, rubbing, boiling in oil, and fumigation may be done either before or after the rattan is exported for manufacture into consumer products.

Important export

Because almost all rattan grows wild and is being harvested so fast, little is known about how much rattan is left or how long it will last.

Next to timber, rattan is Malaysia's most important forest product. In 1982, total exports of the cane, either raw or processed, were worth US \$5.7 million.

Penninsular Malaysia's *orang asli* (aborigines) traditionally used rattan to make baskets and other useful items. It was also an important source of income as they could haul it out of the forest and sell it to processors.

As wicker has been replaced by plastic, and forest life has given way to city jobs, rattan has become less important to the *orang asli*. However, there have been efforts to intercrop rattan with rubber and other crops so that farmers

A rattan furniture factory in China.



Photo: Denis Sing IDRC

can grow the cane to supplement their incomes.

Malaysia is home to nine genera and 104 species of rattan — including *Calamus manau*, which is the most popular in the furniture industry. Unfortunately, manau cane is also the species most endangered by overharvesting.

Enter the Forest Research Institute of Malaysia (FRIM), in Kepong, just outside Kuala Lumpur. FRIM is home to the Rattan Information Centre and the RIC Bulletin — an internationally circulated, quarterly newsletter started several years ago in response to growing academic and industrial interest in rattan.

Because of the disappearance of wild cane and because of the need for adequate nursery stock to supply any future commercial industry, FRIM has been experimenting for the past three years with tissue culture propagation of rattan.

The project has been funded since 1984 by IDRC, which provided equipment and cash as well as six weeks of training in tissue culturing at the University of Calgary, in Canada, for the principal researcher, Aziah Mohamed Yusoff.

Mrs Aziah is experimenting with a seldom-used tissue culture technique known as callus formation. Mature embryos from the plant's seeds are put in a growth medium and produce masses of "callus" cells. These cells are put in another medium to produce somatic embryos — tissue from which shoots can develop. Another growth medium induces the creation of more somatic embryos and of shoots. Finally, the shoots are placed in a rooting medium where plantlets develop.

The reason callus formation is an unpopu-

lar tissue culture method is that it takes as long as one year. Also, mutation can occur during the process, which makes it interesting for researchers, but aggravating for plant breeders.

Mrs Aziah is hopeful that recent work she has done with another, more efficient method known as adventitious shoot formation may hold promise.

Lack of protective coat

Getting the plantlets to survive in soil plots has been a major bottleneck for the research project. Mrs Aziah is investigating the potting medium, root conditions, and fungal attacks as possible reasons for the poor survival rate. However, she thinks the main problem is that the leaves of plants grown in the test tubes lack the waxy coating that protects normal plants from dehydration.

The conditions in which Mrs Aziah's rattan plantlets grow are a far cry from those of the Malaysian jungle. Shoes must be removed before entering the sterile medium-preparation area which is equipped with steam sterilizers and a cabinet for regulating and purifying the air during transfers from one test tube to another.

Ultimately, FRIM might supply plantlets to a commercial growing industry if lab costs could be brought down. But there is little talk about commercial scale-up at this stage. "Our main aim at this moment," says Mrs Aziah, "is to see whether the method is viable for the conservation of the species." ■

Mark Timm is a Canadian freelance journalist who writes on Southeast Asian affairs for several North American, British, and Asian publications.



Photo: Mark Timm

Mangyan woman in Umabang, Philippines, winnows rice. The ancestral land of this tribal people is threatened by outsiders.

WHOSE HOMELAND?

The tribal peoples of the Philippines are attempting to establish their land rights through long-term leases. Legal research may help them go one step further — outright ownership in the form of communal titles.

MARK TIMM

Many of the world's upland tribal communities are under siege. The forests that supply their food, fuel, and shelter are being cut down by logging companies. Mining interests want to extract the minerals beneath their seasonal hillside fields. In some cases, upland villages are flooded by power dams intended to electrify distant cities. Even lowland farmers are moving up into tribal lands as agrobusiness takes over lowland fields.

Many tribal cultures, such as those in the Philippines, have little or no concept of private land ownership or title. The reasoning is that you can't own something you didn't make. In effect, the land is seen as being the communal property of the group who occupies or uses it. This puts such communities at a disadvantage when they complain that outsiders have been granted pasture rights or logging concessions on ancestral tribal lands — lands which have been occupied by the tribal peoples from time immemorial but for which they have no legal proof of ownership, no title. In the Philippines, all lands of a slope greater than 18 degrees — often tribal areas — have actually been declared public land.

Most of the estimated 118 tribal communities in the Philippines have faced at least one of the above-mentioned problems of intrusion. In addition, tribal Filipinos have in past years been confronted with an abusive military and a corrupt regime from which the best they could hope for was indifference.

It is also in the Philippines where some innovative approaches to defending tribal land rights are being tried. The Philippine Association for Intercultural Development (PAFID) is an "intercultural clearing house" for Filipino tribal groups. Established in the late 1960s, PAFID is currently helping about 40 tribal communities do the legal research and political lobbying necessary to set up communal forest leases allowed under a program of the Philippine Ministry of Natural Resources.

The renewable leases run for 25 years and give the community extensive control over resource use in the territory during that time. A board of trustees is set up to make decisions about water management, forest conservation, and other matters.

The difference such control can make is evident if one compares the case of the Mangyan community of Umabang with that of the Ikalahanos community of Imugan.

Umabang is a tiny village nestled in the southern mountains of the Philippine island of Mindoro. A three-hour walk from the nearest road, it is part of a community of 2000 Mangyans who have been trying to set up a 4000-hectare communal forest lease.

The Mangyans of Umabang are poor and many suffer from nutrition-related diseases. They are threatened by the spectre of a mine opening to extract coal from their ancestral lands.

More than 400 kilometres to the north, on the northern part of the island of Luzon, the Ikalahanos people of Imugan once faced simi-

larly dark times. The government was evicting them from what it said was public land, while cronies of then-president Ferdinand Marcos were being given title to 6000 hectares on the mountain opposite the Ikalahanos' land.

It took several court battles and two administrations, but in 1974 the Ikalahanos finally got their communal forest lease for 144 730 hectares. Today, most homes in the community have water piped from a nearby watershed and there is an academy where young Ikalahanos learn about their culture and prepare for further university education. Experimental coffee plantations have been set up and fruit orchards planted. And at a local plant, the Ikalahanos make jellies and jams which they sell in Manila.

But such leases are viewed by many as a stop-gap and there is unease among tribal people because permanency of access to the land is not assured. The Ikalahanos lease, for example, must be renegotiated by 1999. No lease can be renewed more than once. The effect of this could be to discourage a community from investing any long-term effort in its own development.

In an effort to combat this problem, PAFID is conducting research into the legal and social aspects of establishing titles under which the land would be owned by the community as a whole, rather than simply leased. IDRC is funding the work.

Delbert Rice, the executive officer of PAFID and an American Methodist pastor in Imugan, estimates that 3 million tribal people and 15 million hectares could eventually come under communal forest titles.

The idea is legally unprecedented in the Philippines, although it has worked in parts of Africa and Micronesia. The job of PAFID's legal researchers is to unearth court decisions or legislative clauses which would help the communal title concept stand up in court. For example, much Philippine legislation covering resource exploitation makes the granting of licenses for such work "subject to prior right", which would include ancestral claims.

More telling for the success of communal titles or leases may be their acceptability to tribal groups themselves. Traditionally, a tribal 'village' has often been nothing more than a few huts and fields scattered over several hectares. The idea of giving a board of trustees the final say over how any member of the community uses the land could be as big a stumbling block as any court battle.

The Mangyans were convinced of the value of a communal forest lease only after they found out that it meant they could make decisions within their own community rather than having to trudge down to the district capital for permission to do things.

Mr Rice, who is also a trained anthropologist, says the system has usually won acceptance because tribal elders are usually members of the board of trustees in charge of the lease or title. "Communality is not that important within the community," he says. "What is important is the fact that decision-makers are part of the community. Once they get together and make a common decision, they'll stick by it."

Mark Timm is a Canadian freelance journalist based in Southeast Asia. He writes for several North American, British and Asian publications.

LEISHMANIASIS

DEBILITATING, DISFIGURING AND SOMETIMES DEADLY

CHERYL FERGUSON

Children herding livestock in Ethiopia... families living near a newly constructed dam in the Middle East... agricultural workers in Mexico's Yucatan Peninsula and India's Bengal region... men clearing land for new roads in the Peruvian Amazon. All have something in common.

These people and millions of others are at risk of being bitten by sandflies carrying leishmania parasites and catching a tropical disease that is debilitating, disfiguring, and sometimes fatal.

Leishmaniasis is not really one disease but a group of diseases. It has three major forms. *Cutaneous* leishmaniasis produces painful sores and lesions on the body, reducing the victim's ability to work. *Mucocutaneous* leishmaniasis can mutilate the face so badly that victims become social outcasts. And *visceral* leishmaniasis results in an enlarged liver and spleen accompanied by anemia and weight loss, usually causing death.

The leishmaniasis are among the most neglected and least understood of the major tropical diseases, says Dr Pandu Wijeyaratne, a senior program officer in IDRC's Health Sciences Division. The lack of information ranges from limited research on the biting and breeding habits of the sandfly (the "vector") that transmits the diseases, to insufficient data for experts to determine how many people are really infected and affected globally.

Researchers say that such major information gaps make controlling the spread of the disease difficult. But as the economic and social effects of leishmaniasis become more apparent, the search for ways to control it becomes more of a priority.

Leishmaniasis usually strikes the poorest of the poor, says Dr Wijeyaratne. But the expense of sending health care workers to rural areas with reliable "tools" to diagnose the disease is too great for many countries. Treatment for the disease involves daily injections over three to four weeks. This is expensive and time-consuming for health care workers. At the same time, there is no guarantee the treatment will work.

As a disease that more often debilitates than kills, leishmaniasis makes people less able to care for themselves and their dependants. Indeed, they become dependants themselves.

Despite the need for more research on the disease, experts already know there is no possibility of developing one simple, universal control method. For the leishmaniasis are complicated diseases and there are a variety of leishmania parasites, sandfly species, animal reservoirs, and transmission situations.

The need for research on the control of the leishmaniasis was the focus of an IDRC-sponsored international workshop in Ottawa last June that drew 60 specialists from around the world. It was a unique scientific meeting that brought together active researchers in the biological, medical, and social sciences from countries where the disease is endemic.

In the absence of measures such as an effective vaccine, say the researchers, some of the possible measures to control the diseases involve protecting humans from vector sandflies and parasite-carrying animals, or "reservoirs", such as dogs.

Researchers are experimenting with ways to reduce reservoir populations, either by eliminating all potential carriers, or by finding ways to test and identify only the real carriers. However, they admit there may be reservoir animal species of which they are not yet aware.

Leishmaniasis experts are also investigating ways to prevent sandfly contact with humans. Insecticide spraying and protecting skin with clothing, repellent, or netting are all options, but none are foolproof.

Ironically, many development projects are exposing more people to leishmaniasis. Forest clearing and cultivation projects, large water resource schemes, and colonization and resettlement programs bring human beings into areas of high vector and reservoir concentration.

The IDRC workshop made it clear that research methodologies have to be more standardized so that as new leishmaniasis research projects get under way information can be shared between countries. Dr Wijeyaratne says the improved flow of knowledge between researchers can facilitate an improved flow of knowledge to government health planners — the people who can translate research results into disease prevention and cure. ■

Cheryl Ferguson assisted the Reports editorial team for three months last summer after graduating from the Carleton University School of Journalism in Ottawa.

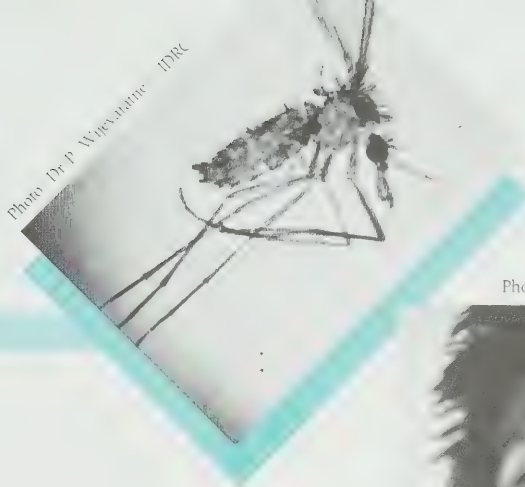
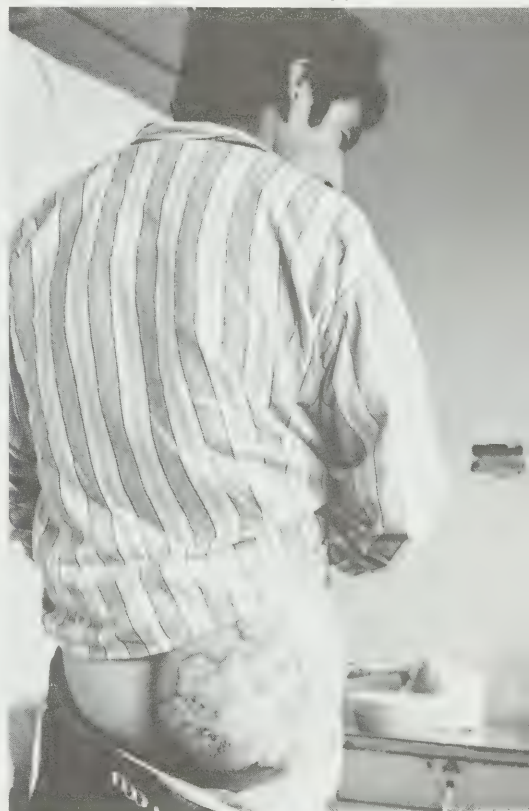


Photo: Dr P. Desjeux

Tragedy of mucocutaneous leishmaniasis. Nasal septum, palate, and throat are also affected. Left, female sandfly, the disease vector.

Photo: Dr P. Wijeyaratne / IDRC



Large lesion on buttock caused by cutaneous leishmaniasis.

KEY FACTS

- In 1979 the World Health Organization estimated that 400 000 new cases of leishmaniasis occurred each year. It is now believed that the disease is severely under-reported and new information suggests 1.5 to 2 million new cases occur every year.
- There are more than six parasites of the protozoan genus *Leishmania* that cause the disease. All are passed via a vector, the sandfly, to people from reservoir animals — dogs, jackals, foxes, rodents, and other mammals. Man can also be a reservoir.
- The disease is strongly associated with occupation. People who work in various farming practices, forestry or deforestation, mining, and fishing have a greater risk of being bitten by sandflies.

ONE CH

CHINA'S RURAL-URBA



Photos: Dr Carol Vlassoff

CAROL VLASSOFF

Is China, despite its policy of one child per family, experiencing a second "fertility peak"?

Recent news reports express official concern over an unexpected rise in the number of births in 1986 as compared with 1985. This increase was revealed by a population change survey conducted by China's State Statistical Bureau (SSB) at the end of 1986. The country's population experienced a net increase (births minus deaths) of 14.7 million people in 1986, in contrast to only 11.7 million in 1985. Since death rates remained low and constant (about 6.7 per thousand population), approximately 3 million more

people were added last year than previously anticipated.

The present fertility increase follows on the heels of international reports of a relaxing of China's birth control campaign. Central Document 7, issued in April 1984, while reiterating the critical need for family planning and a one-child policy for most couples, nevertheless allowed for second children under certain prescribed conditions. In Guangdong and Guangxi, for example, families with one daughter and no sons were permitted to have a second child.

But the recent fertility rise may well lead to a reversal of such leniency. Commenting on this, Shen Yimin, Division Chief of SSB's

Department of Population, said, "We regard the increase in birthrates as very significant. It has aroused the attention of various ministries as well as delegates to the National People's Congress. If current fertility rates continue, we will exceed our target of 1.2 billion by the year 2000."

Natural and temporary phenomenon?

China's earlier "fertility peak" occurred in 1963 when the crude birthrate reached an estimated 49.8, which works out to about six children per family.

Although the 1986 rate of 20.8 represents a rise over the 1985 rate (17.8), it is still remarkably low in comparison with 1960 estimates. Moreover, as the large number of children born from 1963 to 1965 are now entering their peak child-bearing period, the current increase may be largely a reflection of the earlier rise and hence a natural and temporary phenomenon. In other words, 1986 couples may well be having the same number of children as 1985 cohorts; there are simply more of them to have children. While recognizing this possibility, Chinese experts continue to worry and to emphasize the need for close monitoring of population patterns.

High hopes are therefore pinned on the findings of China's in-depth fertility survey which was conducted by SSB prior to its population change survey. That information will help to explain present trends. (See *Reports*, July 1986.) Preliminary results from phase 1 of the IDRC-funded fertility study are soon to be published in Chinese, and in English shortly thereafter. However, the results of phase 2, which is currently under way, are awaited even more eagerly since they will provide greater insight into the recent fertility peak which succeeded phase 1 data collection.

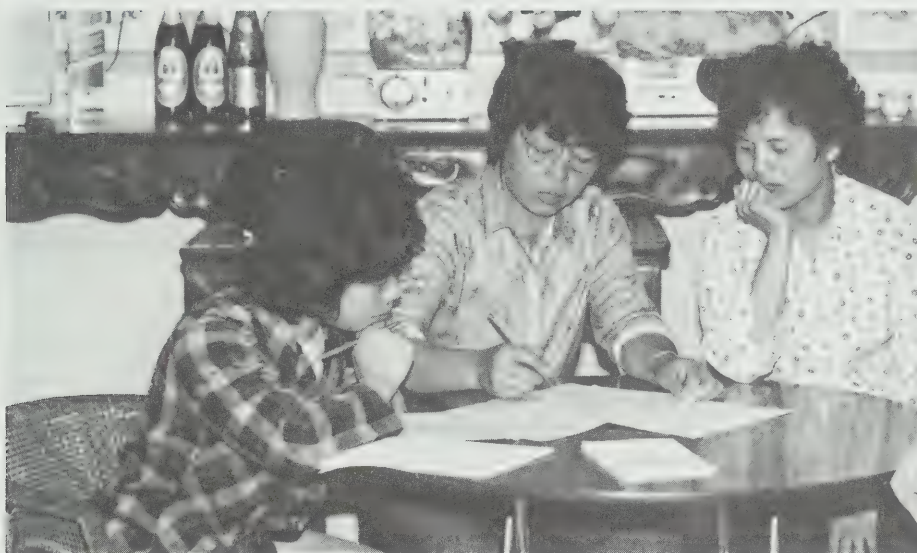
Phase 2 covers six survey areas (five rural provinces and the municipality of Beijing), with a total sample of about 38 000 women.

Last April, during the interviewing period, representatives from IDRC and from the International Statistical Research Centre, which is providing technical assistance to the study, visited field sites in Beijing and Guangdong. Observations from the interviews, as well as discussions with SSB project staff, indicate that the one-child policy is meeting considerable opposition, especially in rural areas.

Major factors in the policy's relatively low level of success in the countryside are the higher infant mortality rate there and the poorer quality of medical treatment. One woman interviewed in rural Guangdong, wanting to assure the survival of at least one son, consented to sterilization only after her third delivery, which resulted in twins. Unfortunately, the twins died, after which it was discovered that her only son, the firstborn, was mentally handicapped. All of this, she reported, "left the family very sad and resentful of the

LD OR TWO?

LIT



A Chinese survey indicates major opposition to the one-child policy, mainly in rural areas.

government". The experiences of such women will be written up as special case studies after the interviewing.

Insufficient incentives

Another reason for the apparent lack of success of the single-child policy in rural areas, explained the project staff, is the greater affluence of farmers compared with urban residents. One-child policy incentives are generally insufficient to persuade relatively prosperous rural families to forego the benefits of additional children.

Interestingly, incentives vary considerably from province to province, district to district, brigade to brigade, urban to rural areas, and even among urban centres.

In urban areas, one-child certificate holders enjoy certain common benefits. These include a family allowance of 5 Yuan (CA \$2.75) per month, priority for urban housing, free medical treatment for the child, assured entry into kindergarten (where scarce seats are highly valued), up to 12 months' paid maternity leave, and toys for the child distributed on a special day each year.

In rural areas, on the other hand, incentives range from substantial to nonexistent. In the wealthier brigades, couples are paid 500 to 600 Yuan if they sign the certificate. Yet in others there are no such rewards. When asked about this discrepancy, the deputy director of the Guangdong Statistical Bureau explained that, because rural people tend to have more than one child, incentives are simply wasted. Many rural couples, he said, sign the certificate and accept payment, then proceed to have more children. He added that very few Chinese women, even among those who hold certificates, agree to be sterilized after only one child.

Legislation governing land distribution under what is known as the "responsibility system" tends to put an early brake on fertility, even for those couples failing to stop at only one child. For families with up to two children, land is allocated according to the number of family members. Those families with more than two children may not accrue additional land. Unoccupied land is held in reserve by the government for future generations and in-migrants from other parts of the country.

Some interviewees, particularly those in flourishing rural Guangdong, were remarkably undeterred by official directives. One proud young mother of one son determinedly planned to have another child, even though she had been visited by family planning workers armed with one-child propaganda. She also said that she and her husband, both factory-workers, had given up their land since they had no interest in farming.

'Vasectomies' didn't work

A further problem, reported by some rural couples who had signed the one-child certificate and appeared to have earnestly attempted to comply, was contraceptive failure. Survey personnel were surprised to find that in at least four cases where husbands of respondents had apparently been sterilized, pregnancies nevertheless resulted. These contraceptive failures were apparently due to a defective local variant of the vasectomy which has been discontinued. The existence of this indigenous technique was previously unknown to family planning officials, and its replacement by more reliable modern methods should contribute to greater acceptance of male sterilization.

Other survey respondents reported becoming pregnant while using an IUD but refused to

have an abortion. "It is not my fault that it didn't work," one woman explained, "so I am going to have this baby!"

In urban areas, by contrast, the one-child policy is having considerably more success. In Beijing especially, close adherence to the government's prescription was observed, though usually at the cost of great personal sacrifice to consenting couples. One 35-year-old woman, for instance, had been married only seven years, having deliberately postponed marriage in order to delay child-bearing. She had already had one son, after which she had used a variety of contraceptive methods including the IUD, condom, and rhythm (sometimes in combination). None had worked for her and she became pregnant twice. These pregnancies she dutifully aborted even though she confessed that she had really wanted two children.

Relaxing the policies?

Is there any way, then, of relaxing the rigid one-child policy to allow Chinese couples a little more freedom, while still preserving the goal of stabilizing the population at 1.2 billion by the year 2000?

In a recent article in *Population and Development Review*, John Bongaarts demonstrates that, if Chinese women were to postpone having their first child until age 27 and then wait four years to have a second child, China could keep the population from reaching 1.2 billion. One of the additional benefits of such a two-child rather than one-child policy, says Dr Bongaarts, would be the extra family support to parents in old age, reducing the need for high levels of government assistance. Female infanticide, which Chinese authorities claim is virtually nonexistent but which is still reported sporadically in the Western media, would also be curtailed.

Chinese policymakers, while impressed with such logic, are nonetheless skeptical. They worry that any relaxation of the one-child policy would result in a sudden rush of births among Chinese couples anxious to take advantage of the new freedom. "As soon as the policy opens up to permit two children," one researcher commented, "everyone will hurry to have another child. No one will be willing to wait four years in case the policy changes again!"

It therefore seems likely that the current policy will remain in effect for some time to come, but tempered by considerable tolerance for the daily problems and realities of Chinese families, as revealed by current research. ■

Dr Carol Vlassoff is a scientist/economist with the Tropical Diseases Research Programme of the World Health Organization in Geneva. She was previously Associate Director, responsible for IDRC's Population and Development Research Program.

Women in development

What impact do women have on Argentina's trade unions? How do women in Barbados deal with an economic crisis? What role do women play in India's agricultural development?

IDRC has created a Women in Development (WID) Unit to support research projects on these and other questions related to the roles and problems of Third World women.

The new unit will enable IDRC to fund projects in areas currently not covered by IDRC's other programs, says Dr Eva Rathgeber, the Unit's coordinator.

Projects funded by the WID Unit will focus on women in industry, in the informal sector, and in agricultural production, as well as on the social participation of women. Potential research subjects range from the state of nutrition in families with working mothers, to women's access to land ownership and credit, to governments' capacity to improve conditions for women.

Funding projects is only part of the WID mandate, says Dr Rathgeber. It will also be an advisory body to other IDRC divisions that fund projects affecting women in some way, and will try to increase awareness at IDRC of the importance of considering the effects of projects on women.

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Cheryl Ferguson
Ottawa

A decade of Pearson Fellows

Attention all Pearson Fellows, past and present — IDRC wants to decorate your lapels. To commemorate the 10th anniversary of its Pearson Fellowship Program, a red and white pin has been designed for all recipients.

The program is named after the late Lester B. Pearson, a former Prime Minister of Canada, a Nobel Peace Prize laureate, and past IDRC Chairman. Each year it brings as many as 20 young public servants from developing countries to Canada for professional training in public administration and management.

The pins are intended to give recognition to the approximately

100 Pearson Fellows in their home countries, and increase awareness among public servants of the opportunities for specialized training offered by the program.

Wherever possible, the pins will be awarded in person by an IDRC representative. In other cases, they will be mailed.

IDRC invites all past recipients to write to its Fellowships and Awards Division with their current address.

Information Technology for Development

Good development decisions require good information.

IDRC has long supported and promoted innovations in information technology to ensure that decision-makers in developing countries have access to the right information. It is thus with a sense of shared purpose that IDRC's Information Sciences Division welcomes to the international scene a new journal, *Information Technology for Development*.

The 33 papers in the first five quarterly issues cover a range of information technology-related topics: applications, policy and management issues, training, international cooperation, and five national surveys of information technology activities. In particular, the papers on applications and the national surveys could be of real help to information specialists in developing countries. They depict what has actually been accomplished in Third World situations with technologies such as telecommunications and microcomputers, and in various sectors such as banking, agriculture, education, and public transport.

One of the most interesting papers describes a project in Swaziland in which a Land-Rover was equipped with several information processing and communications facilities. Dubbed "the knowledge equivalent of the tractor or the plough", the vehicle proved that impressive information technology can be provided almost anywhere on earth, although the cost is still far too high for most developing country users of tractors or ploughs. Yet the concept is heartening, and this journal helps to establish that such ideas are being taken seriously.

Information Technology for Development is published by Oxford University Press in association with Unesco and the UK Council for Computing Development.

For more information, contact:
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Walton Street
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UK

Peter Browne
Information Sciences Division
IDRC

Our common technologies

The report of the World Commission on Development and the Environment says the world must quickly design environmental strategies to allow nations to break away from the often destructive processes of growth and development, to sustainable development paths.

This will mean broadening the developing world's access to environmentally sound technologies, says the report entitled *Our Common Future*, commonly known as the Brundtland Report after the Commission's chairperson, Gro Harlem Brundtland, the Prime Minister of Norway.

"The promotion of sustainable growth will require an organized effort to develop and diffuse new technologies, such as those for agricultural production, renewable energy systems, and pollution control." This international exchange of technologies traditionally occurs through trade in improved equipment, technology transfer agreements, provision of experts, and research collaboration. But new technologies are not always reaching the people who need them.

Many Third World countries cannot afford to pay the fees and royalties for commercially developed technologies, says the report. This creates gaps in technical capabilities between rich and poor countries.

The gap is widest in areas most relevant to the goal of sustainable growth — biotechnology and genetic engineering, new energy sources, new materials and substitutes, and low-waste and nonpolluting technologies.

Our Common Future says it will be up to the developing countries,

individually and as a group, to improve their research and technological capabilities. This could be accomplished via cooperative research projects in areas such as dryland agriculture, tropical forestry, pollution control in small enterprises, and low-cost housing. The report suggests the participating countries sign an agreement to guarantee equitable sharing and widespread diffusion of technologies they develop.

World Bank's new concern

The World Bank has been criticized in recent years for launching a number of development projects that turned into environmental disasters. After conducting an in-house study, the Bank has announced plans to become more environmentally sensitive, including the creation of its own internal, environmental watchdog department with a staff of up to 100.

In May of this year, the Bank's President, Barber Conable, announced a series of new environmental policies and initiatives. Plans are in the works for a program to reduce desertification in Africa, a campaign to protect the world's tropical forests, and a project to safeguard the Mediterranean seacoast.

Over the next five years the World Bank will support studies in close to 30 countries whose environments are threatened, to provide an overview of world environmental issues.

At the Bank's Washington headquarters, the environment department will formulate global environmental policy for all Bank Projects, says William Brannigan, a World Bank official. In the various developing regions, local nongovernment groups will be contracted to ensure that the projects in the area are environmentally sound.

Cheryl Ferguson
Ottawa

Ringling ears in India

Researchers in India are finding that the everyday sounds of the cities — from the roar of trucks and scooters, to the blare of loudspeakers atop mosques and temples — can lead to hearing loss.

New Releases

A study by the Saha Institute of Nuclear Physics and Medical College in Calcutta revealed that eight out of every 100 people in that city suffer the effects of noise pollution.

In Bombay, a recent survey found 40 percent of cobblers, stall operators, fruit and vegetable vendors, and other sidewalk merchants suffer from ringing in the ears, which is called tinnitus, caused by the constant barrage of noise.

Prof. K. Kameshwaren of the School of Basic Medicine Science in Bangalore warns that if noise levels keep rising as they have done in the past 20 years "we can expect that no one over the age of 10 will have normal hearing by the end of the century."

In a four-month study in Pune, Dr S.R. Salunke and Dr Maya Natu found that nearly 90 percent of state truck drivers suffered from noise-induced hearing loss. The doctors believe there is a relationship between noise levels and road accidents.

Atiya Singh
New Delhi
Gemini News

AIDS: Breaking New Ground

Scientists, policymakers, and public health specialists from both the developed and developing world will gather in Montreal, Canada, in June 1989 for the Fifth International Conference on AIDS. The meeting will be jointly sponsored by IDRC and the Canadian Ministry of National Health and Welfare.

The conference theme is "Breaking New Ground". It is expected to attract a wide range of AIDS specialists — from researchers in molecular biology, to the front line practitioners who deal with AIDS patients every day.

Conference organizers expect the conference to highlight the global and multidisciplinary nature of the AIDS issue.

For more information contact:
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Tropical Root Crops: Root Crops and the African Food Crisis

Editors: E.R. Terry, M.O. Akoroda, O.B. Arene, IDRC-258e, 197 pp.

This publication contains the 64 papers, in full or abstract form, that were presented or discussed at the third triennial symposium of the International Society of Tropical Root Crops (Africa Branch). The symposium theme was "Root Crops and the African Food Crisis".

The root crops studied included cassava, yam, sweet potato, cocoyam, and other minor root crops. The topics of the papers included breeding and agronomy, protection, post-harvest technology, and socioeconomics of production and utilization. Overall, the papers indicated that, with proven new technologies and management practices, root crops can play a major role in alleviating the African food crisis.

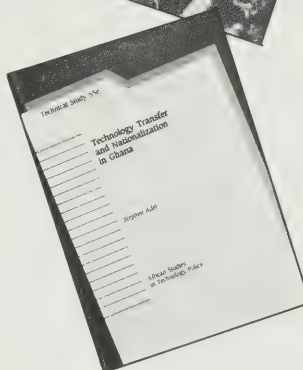
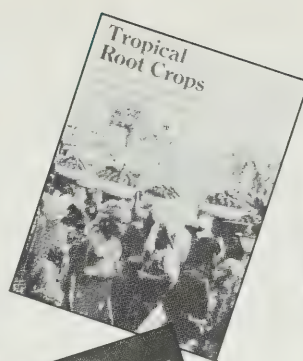
Market Research for Food Products and Processes in Developing Countries

Editors: R.H. Young and C.V. MacCormac
IDRC-249e, 144 pp.

Knowledge and experience in the identification and analysis of existing and potential markets for new food products and processes in the developing world are minimal. The main concerns relate to the identification of the needs of low-income communities, particularly in rural areas, and the future direction and strategy of food technology research to satisfy those needs.

From 1 to 4 April 1986, IDRC sponsored a workshop in Singapore that brought together food scientists, marketing specialists, and economists. The objectives of the meeting were to create a greater awareness of the opportunities for using market research in guiding food technology projects in developing countries and to highlight market research methodologies that are appropriate for use by Asian scientists.

This publication provides case study examples demonstrating market research in food technology projects along with the conclusions and recommendations of the participants on ways to increase the use of this type of analysis in future research.



Technology Transfer and Nationalization in Ghana: African Studies in Technology Policy

By Stephen Adei,
IDRC-TS55e, 114pp.

In nationalizing foreign companies, developing countries often do not adequately consider technological capacity as a major determinant of successful operation. As a result, nationalized companies are often not provided with adequate technical, material, and institutional resources. The effect is intensified when the company has been dependent on a transnational corporation (TNC) for vital inputs.

This study of the nationalized timber industry in Ghana examines the performance of two companies — a TNC subsidiary and a company owned by a resident expatriate. The neglect of technology issues before, during, and after they were nationalized has meant that expected economic gains cannot be realized, particularly in the case of the former TNC subsidiary.

The study concludes that nationalization of subsidiaries may not be a viable option where technology transfer has not been accomplished and where the state, the new owner, fails to provide and refurbish operating resources.

BAMBOO — The Miracle Grass

This 27-minute colour film, shot on location in Southeast Asia, will be released in October 1987. It was produced by IDRC's Communications Division and is available as 16mm prints or as video cassettes in NTSC, PAL or SECAM signal systems (U-matic, VHS, or Betamax formats). Initially available in English and French only.

Bamboo's graceful shape has inspired centuries of poets and artists and has traditionally been used to make everything from chopsticks and baskets to furniture and fishing net frames. Today its many uses inspire scientists and engineers — bamboo is an important source of food, shelter, medicine, and fuel for half the world's population.

As the world's fastest growing plant, it seems to grow in abundance, but it is being harvested with little attention to conservation. With its thousand and one uses, consumption can exceed natural supply, placing some forests in danger.

The film brings to the screen the faces of the people who depend on bamboo in their daily lives, traveling from a bamboo forest, to an efficient bamboo-shoot processing plant, to a laboratory where scientists are measuring bamboo's physical properties.

BAMBOO — The Miracle Grass documents a network of IDRC projects investigating ways to increase the production and quality of bamboo in Asia and to come up with even more uses for this valuable plant.

BAMBOO: a new film from IDRC



BAMBOO — The Miracle Grass, a new film from IDRC. See p. 27.

Photo: Denis Sing / IDRC

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THE
IDRC



DESIGNING
BETTER FISH



CANADA

Letters

Your feedback is appreciated

The editors of Reports welcome letters of comment and information from readers. Perhaps you're engaged in development work related to the projects described in the magazine. If so, other readers may be interested in what you have to say. Or, if you wish to take issue with an article or clarify certain points, drop us a line. Letters should not exceed 250 words and are normally edited. Write to:

The Editors
IDRC Reports
P.O. Box 8500
Ottawa, Canada
K1G 3H9

No development without debt relief

David Glover's insightful article on the present debacle faced by Third World countries over increasing debt repayment problems is certainly a timely inclusion in *The IDRC Reports* ("Striking a better deal for the debtor countries", July 1987).

It is becoming more and more apparent that, regardless of the tremendous work and capital that are injected by development organizations into the Third World, healthy development will not be sustainable until debt relief solutions are sought.

With growing economic distress in debtor countries, disenchantment and frustration with the present debt strategy have been increasing on a daily basis. The present debt servicing methods have not only left most Third World countries poorer than they were 10 years ago, but have also had a negative impact on their fragile health, educational, and housing conditions.

Debt problems have become increasingly worse as the Third World countries struggle to live with them. More debt, more problems. More problems, more debt. More "muddling" through or "rescheduling" operations will not help. Evidently, new approaches, such as multilateral efforts, are needed. Failure to find adequate solutions will lead to events which would prompt further alarm, and probably catastrophic outcomes.

Sridatt Lakhan
Research Director
Canada Caribbean Research
Committee
Toronto, Canada

Farmers question efforts to protect trees

The January 1987 issue of *IDRC Reports* contained an article which interested me very much: "Agroforestry in Kenya: New Roots for a Parched Land" (p. 6). A program of the Dryland Agroforestry Research Project, led by Dr Francis Arap Sang and Richard Mwendandu, was described in which Balanites trees were protected and pruned to promote better production.

I am an agricultural engineer working in a very dry area of northern Senegal, where the Balanites tree is also found. Since reading this article I have been attempting to promote the protection (with thorn branches, as most things are protected here) of the Balanites with little success.

"The trees belong to everyone," the herders say, "and no one has the right to protect them for himself." They are also afraid that the goats will have nothing left to eat if all the trees are protected.

Needless to say, I am interested in more information about this project. How exactly were the trenches dug? What about the social questions of tree tenure, etc.? How was motivation carried out? I would appreciate the address of the Dryland Agroforestry Research Project, or any other information you might have on this project.

Thank you very much. Your magazine is excellent, and I have gotten many useful ideas from it.

Jane Rossing
N' Dioum, Senegal

Editor's note: The following is an edited excerpt from Dr Arap Sang's letter of reply to Ms Rossing:

"I recommend you set up a few demonstration plots of up to 10 trees in various sites. Invite the beneficiaries to come and see the

Photo: Gerry Toomey / IDRC



Dr Arap Sang: Giving trees a second chance.

performance. I am convinced that if the results match those reported in our Research Note No. 2, the people will implement the idea on their own.

You also raised the question of land tenure. The land at our project site has been adjudicated into private holdings but at the time of the project's initiation, communal grazing was still practised to some degree. The key issue was, however, to involve the people at the grass-roots so that they became part of the decision-making machinery."

Reports has sent Ms Rossing a copy of Dr Arap Sang's report on Balanites protection.

Poorest hit hardest by drought

Your recent article "Predicting Famine" (Vol. 16, No. 2) suggests that human behavioral changes are useful as early warning indicators of food stress and could be important for organizing more timely aid interventions.

I would like to confirm that the indicators listed were also generally valid for a group of northern Kenyan herders who lost up to 75 percent of their cattle during the 1984 drought. The Samburu sold large quantities of livestock (particularly goats), migrated for wage labor, and consumed the limited wild foods available. Predictably, livestock prices tumbled to between 20 and 50 percent of their dry season value, and, while state-controlled grain prices did not rise, the supply of grain was so erratic that herders could not purchase it about 60 percent of the time.

It is important to note that the poor often have the greatest difficulty in obtaining food during a drought. In Samburu, shopkeepers extended credit to the wealthy who were then able to take advantage of maize meal availability by buying entire 90-kilogram sacks. The poor

had to rely on livestock sales to generate cash and, being able to purchase only 10 kilograms at a time, became the main victims of the irregularity of grain supply. Further, because the goat market was glutted, and because the poor had to sell, low-income herders offered their most valuable animals for sale. Thus, those who could least afford to sold reproductive and pregnant animals at depressed prices.

The Samburu study suggests that for warning systems to be sufficiently "early" they should focus on those segments of the population most susceptible to famine. Those most at risk are often the poorer families, and early warning systems that are class-differentiating (or which take account of differing levels of vulnerability) will be most sensitive to food stress. In the Samburu case, and in many other herding areas, the availability of grain to the poor, as well as the terms of trade between livestock and grain prices, would be important early indicators of stress.

Dr Louise Sperling
Ottawa, Canada

Editor's Note: Dr Sperling's work on the Samburu herders was undertaken while she was a research associate at the University of Nairobi's Institute for Development Studies. A paper by her, entitled "Food Acquisition during the African Drought of 1983-1984: A Study of Kenyan Herders" is to be published in the journal Disasters.

Reports

THE IDRC

Cover photo: Selling fish at a village market near Prachi Buri, Thailand. By improving fish stocks, genetics research benefits aquaculturalists, fishmongers, and consumers. See articles pages 4-9.



Photo: Denis Sing / IDRC

IDRC

The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in five sectors: agriculture, food, and nutrition sciences; health sciences; information sciences; social sciences; and communications. IDRC is financed solely by the Parliament of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are located at 250 Albert Street, Ottawa, Canada (P.O. Box 8500, Ottawa, Canada K1G 3H9). Regional offices are located in East Africa (P.O. Box 62084, Nairobi, Kenya); West Africa (B.P. 11007, C.D. Annexe, Dakar, Sénégal); Asia (Tanglin P.O. Box 101, Singapore 9124, Republic of Singapore); South Asia (11 Jorbagh, New Delhi 110003, India); Latin America (Apartado Aéreo 53016, Bogotá D.E., Colombia); and the Middle East (P.O. Box 14, Orman, Giza, Cairo, Egypt).

The IDRC Reports

The IDRC Reports and its companion editions in French and Spanish — *Le CRDI Explore* and *El CIID Informa* — are published quarterly by the International Development Research Centre. Their aim is to keep readers informed of the activities of IDRC and to present articles on subjects related to the Centre's fields of interest. An Arabic version *بحوث للتنمية* is published annually. Copies are available on request from the Communications Division, IDRC. *Editor-in-Chief*: Jean-Marc Fleury. *Associate Editors*: Gerry Toomey (English edition), Robert Charbonneau (French edition). *Spanish edition*: Stella de Feferbaum.

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CONTENTS

Letters	2
OUR THEME THIS ISSUE: DESIGNING BETTER FISH	
A new net on ancient waters Genetically speaking, cultured fish haven't improved much over the centuries. A network of Asian and Canadian geneticists is attempting to reverse the pattern. <i>Roger Doyle and Gary Newkirk.</i>	4
Perfecting the prolific tilapia Filipinos like to eat fish and tilapia is a favourite. Researchers are breeding better strains and learning to spot good prospects among young fish. <i>Mark Timm.</i>	6
Coaxing fish to breed A drug-hormone kit developed by Canadian and Chinese scientists simplifies the process of inducing fish to spawn in captivity. <i>Gerry Porter.</i>	8
Education — Haiti's elusive dream	10
Haiti's French schools are out of sync with its Creole culture. Caribbean researchers examine the causes of school failure. <i>Robert Landry.</i>	
Morocco's Koranic schools	11
Traditional Muslim schools teach the Koran but haven't been tapped as a vehicle for other learning or literacy. <i>Fatima Bekkhar.</i>	
Better burning lignite	12
Researchers adapt a Canadian coal conversion process for use in the Turkish steel industry. <i>Robert Charbonneau.</i>	
Putting the squeeze on oil palm	14
A photofeature on how villagers in Cameroon extract the palm oil they use for cooking. <i>Denis Marchand.</i>	
Too many scholars, not enough jobs	16
After being educated abroad, many returning Tunisians can't find jobs that meet their expectations. So they emigrate. <i>Moncef Mahroug.</i>	
Priming the PVC pump	17
Third World handpump manufacturers will soon have a new ally — a research and training centre in Malaysia. <i>Gerry Toomey.</i>	
Water for the barrios	18
The Malaysian-built Unimade handpump brings clean water to Filipino villagers. Their experience is also part of the debugging process.	
Banking the rain	20
Filipino villagers are using a simple technique called ferrocement to build sturdy cisterns for storing potable rainwater. <i>Gerry Toomey.</i>	
Improved cookstove programs	22
A brief look at efforts, old and new, to introduce better cookstoves to Third World communities. <i>Hartmut Krugmann.</i>	
Commentary	24
Western technology transfers have hurt the Third World. An indigenous development model is needed. <i>Bruno Wambi.</i>	
Briefs	26
News and trends in international development.	
New releases from IDRC	27

A NEW NET ON ANCIENT WATERS



Photos: Dr Gary Newkirk

Harvesting fish near Shanghai, China. At least six species are farmed in the same pond.

ROGER DOYLE and GARY NEWKIRK

Maize, wheat, rice, poultry, cattle . . . almost all of the primary foods of humankind have been so greatly improved genetically that their low-yield ancestors can barely be recognized. The one exception is fish.

The domestication of fish, which for some species has gone on for thousands of years, has produced only small genetic changes — not all of them for the better. A network of researchers in Canada, China, India, Indonesia, the Philippines, and Thailand is now betting that

new approaches to fish genetics can bring about spectacular improvements in this important, age-old source of food for people.

Starting with a project at the National Inland Fisheries Institute in Thailand (NIFI) in 1982, IDRC has been helping to develop a network that links aquaculture genetics projects in Asian countries with each other and with Dalhousie University in Canada. The objective is to produce, using modern selection techniques, strains of fish that grow much faster and are disease resistant.

The network linkages ensure that the special-

ized expertise, training resources, and research findings of geneticists in each country are available to the others. They also help to prevent unnecessary duplication of efforts.

One might expect that, because of aquaculture's long history in countries such as China, fish would have been domesticated in much the same way animals and crops have been. Several aspects of fish biology can explain why this hasn't happened.

To begin with, a fish's genetic makeup is often obscured in the artificial environment of the farmer's pond. Conditions are crowded,

Wuchang fish: profitable species and focus of IDRC-supported research at Shanghai Fisheries University.



mortality of immature fish is high, and growth is strongly affected by behavioural interactions among fish. Thus, even though a farmer may select the biggest fish at breeding time, these may not be the best fish genetically speaking.

There is nothing to indicate, however, that fish do not have the same kind of genetic controls and genetic variation that occur in, say, chickens. So why, even in experimental situations, has it been so difficult to produce a genetic improvement?

The scientists in the IDRC-supported fish genetics network believe it is because the special features of fish biology have not been recognized. Experiments that work so well on land are not easy to conduct in water where environmental variables are hard to control and where it's difficult to replicate an experiment.

Rather than ignore these essential characteristics of fish, the network scientists are trying to cope with them by using new, more realistic genetic models and experiment designs.

Although the network is young, it has already made considerable progress. It now includes the following genetics projects:

China joined the network in 1986. Prof. Li Sifa at Shanghai Fisheries University recently began a selection program to improve grass carp and Wuchang fish (*Megalobrama*). His research team will take advantage of the large experimental fish farm recently started by the University. It will also work with the Nanhui National Fish Farm which produces 168 tonnes of fish a year.

One reason that Chinese carps haven't become domesticated is that the fish farmers often go back to the rivers for brood stock. With careful control of selection and inbreeding, it is expected that this project will produce improved stock and provide the management procedures needed for long-term stock maintenance.

In **Indonesia**, many valuable local strains of carp are being genetically mixed with other stocks or, worse, are becoming extinct. In response, the Research Institute for Inland Fisheries at Bogor, under its director, Dr Atmadja Hardjamulia, has been collecting genetically diverse strains of carp (*Cyprinus carpio*) from Java and elsewhere in the country. The specimens are maintained in underwater cages at Jatiluhur in West Java.

This work is part of the genetic conservation or "gene banking" program which has become an important component of the genetics project. It is closely associated with a selection and hybridization program, as well as with a program of field evaluation of the strains.

Under the management of Mrs Hania Suharto, a program is under way to develop specialized strains that differ genetically with regard to traits such as shape, colour, growth rate, and disease resistance. Then by cross-breeding these strains, new hybrid stock may be produced with specific combinations of these traits suitable for specific situations or markets.

A technique developed at Dalhousie University for estimating the growth rate of individual fish is now being used in Indonesia (see below). New designs of genetics experiments and of brood stock management systems, worked out at Dalhousie on experimental stocks, are also being used in the field in Indonesia and will be used in other projects soon.

In the **Philippines**, the focus of research is the improvement of strains of tilapia, a spiny-finned freshwater fish, prized by both Africans and Asians for its taste. Network projects with Mr Terry Abella at Central Luzon State University, Mrs Zubaida Basiao at the Southeast Asian Fisheries Development Center (SEAFDEC), and Dr Cesar Villegas at SEAFDEC are selecting for growth, stress resistance, and tolerance to salinity. (See article, page 6.)

In **Thailand**, Mrs Parnsri Jarimopas at the National Inland Fisheries Institute (NIFI) has been working with red tilapia (*O. nilotica*). So far she has bred four or five generations, at each stage selecting for high growth rate. Preliminary estimates are that the rate of genetic improvement of these fish is comparable to rates observed in poultry. These fish are now being tested prior to being made available to farmers.

Mrs Supattra Uraiwan has also attempted to improve growth rates, but her techniques are indirect. Over several fish generations, she has selected for "age at maturation". Fish in which sexual maturation is delayed are in effect able to transform the food they eat into overall body growth rather than gonad development. For the fish farmer, this is a desirable characteristic.

A 14-month study of traditional aquaculture near Chiangmai in northern Thailand by Miss Atchara Wongsangchan has shown that routine farm operations can exert a strong negative influence on the genetic development of carp and tilapia. Farmers unwittingly select for smaller rather than larger fish when they sell off the fastest-growing fish and are left with the slow-growing fish when it comes time to select brood stock. This "reverse selection" has previously been noted in the cultivation of giant freshwater prawns in Thailand and carp in India.

Reverse selection may explain why little or no genetic improvement has occurred in domesticated fish in Southeast Asia. In any case, there are simple ways to avoid the problem, and the network is planning training programs and handbooks for farmers and fisheries officers.

In **Canada**, the role of Dalhousie University is to provide training and leadership in the development of new measurement techniques, new designs of genetics experiments, and new data analysis procedures. Participants from various countries in the network visit Dalhousie for research collaboration and training. In some cases, training may include three months of technical upgrading or work toward a master of science degree or doctorate.

A number of techniques developed at Dalhousie are being applied in the Asian projects. Among them is a procedure for estimating the growth rate of individual fish. This is done by measuring the tiny concentric ridges on their scales (called circuli) which, like the rings inside a tree, provide a permanent record of growth. The technique is useful in cases where the ages of the fish in a pond are not known and the monitoring of individuals would be impossible.

The procedure allows differences in a fish's growth rate to be verified in as few as 10 days after a change in the feeding ration. This is an extremely important finding since the duration and complexity of a genetic, nutritional, or other experiment can be reduced drastically.

The technique has been tested in enough situations and enough countries to show its value in both genetic and nongenetic research with goldfish, carp, medaka, and tilapia. It is now being tested on other species and the scientists at Dalhousie are continuing to refine the technique.

The procedure, developed specifically for use in the genetics network, is rapidly finding application elsewhere. For example, a project in northeastern Thailand, funded jointly by the Canadian International Development Agency and the Thai government, is using it to evaluate fish growth conditions in farm ponds and reservoirs. In particular, the procedure will assist in the rapid detection of acute environmental stresses such as overcrowding, inadequate feeding, and poor water quality.

The leader of this part of the Thailand/CIDA project, Dr Oopatham Pawaputanon, spent part of 1987 at Dalhousie University working with Canadian and Asian students and researchers in the fish genetics network.

In cages and ponds, the growth of small fish

PERFECTING THE PROLIFERATION OF TILAPIA

IN THE
PHILIPPINES

MARK TIMM

In the coming decades, aquaculture will become a growing source of fish protein in the human diet. It will be of special importance to developing countries such as the Philippines where other sources of protein are not always readily available at a low cost.

It is in Asia that aquaculture is most widespread and has been practised longest. In 1983, Asian aquaculture produced 5.2 million tonnes of fish or 75 percent of world production of cultured fish. But that represented only 15 percent of all the fish produced in the region. As the world's catch of wild fish levels off or declines, aquaculture will have to come to the rescue.

Aquaculture is moving quickly to complete dependence on stocks propagated artificially on fish farms. This increases the importance of genetic research to improve the quality of fish "seed". The aquaculture industry also faces increasing production costs — particularly in the area of feeds. Genetic improvement would enable fish farmers to save on these costs by improving production efficiency.

"Asian countries are just developing the trained scientists who can work in this field," says Mrs Zubaida Basiao, a fish geneticist in the Philippines. Her research aims to help hatcheries to identify very early which young fish will grow quickly into healthy fish. It is part of an Asian-Canadian network that brings together geneticists from six countries. (See previous article.)

Three projects in the Philippines are focusing on *Oreochromis*, a freshwater fish commonly known as tilapia. At the Central Luzon State University, researchers are selecting tilapia strains for pond culture in keeping with the network's overall objective of increasing domestication in the industry.

Tilapia is quickly becoming one of the most popular species in Asian aquaculture. It eats virtually anything and is prolific. Its market versatility has earned it the nickname "aquatic chicken".

Some countries are finding that tilapia has good export potential. Israel, for example, is already exporting to the United States where the market is estimated at US\$100 million.

A number of Asian countries such as the



To preserve the genetic diversity of Indonesian carps, scientists collect the various strains and keep them in underwater cages.

can be inhibited by competition, especially for food, from larger fish. The small fish hide and don't eat properly. Although they may possess the genetic potential to grow quickly into large fish, the competitive pond environment has, in effect, masked this desirable characteristic. And when it comes time for the fish breeder or geneticist to select brood stock from the pond, the small ones are automatically passed over.

A number of selection procedures developed at Dalhousie should help to prevent this problem in future. One of them calls for fish to be separated into groups by size (size-specific selection) at the beginning of an experiment. Selection of the fastest-growing fish can then proceed without many of the negative effects of competition.

A technique that allows a fish's sex to be determined sooner and before size differences become established is also being developed by Dalhousie. It is based on the measurement of various physical characteristics of the young fish (called multivariate morphometry). One advantage of knowing the sex early is that males and females can be separated at an early stage. This eliminates the cues that trigger sexual development and reproductive behaviour, and allows the fish to put their energy into growth instead.

The same technique will also become indispensable in working with tilapia and the multitude of hybrid combinations possible, in order to determine strain, population, and species composition of individual fish.

Inbred lines of tilapia are being established so that simple techniques for measuring and controlling inbreeding can be developed. (A certain level of inbreeding can result in undesirable characteristics such as susceptibility to disease.)

Early results from the network projects support the hypothesis that domesticated fish are tamer and grow faster than their wild counterparts. This is further support for the belief that aquaculture systems should be genetically closed, that is, not supplemented with fish from wild stocks.

The exchange of staff, data, techniques, and ideas is essential to the success of the Asian research network. In addition to the contact made possible through training programs and site visits, researchers regularly see each other at network meetings and workshops. There, results are discussed, research plans updated, and data analysis problems shared and solved. Three such workshops have been held — in Singapore, Thailand, and Indonesia.

The network is currently focused sharply on the selection and domestication of fish. It omits important areas of fish genetics such as genetic sex manipulation and cytogenetics (the study of heredity using the techniques of cell biology) that are legitimate concerns in the Asian region.

The philosophy of the network has been to concentrate its efforts and "go for the gold" — that is, use modern selection techniques to produce new strains with higher yields. As the demand for more profitable, disease-resistant fish becomes urgent, even the best of the current strains will soon prove to be genetically inadequate. ■

Roger Doyle and Gary Newkirk are faculty members of the biology department of Dalhousie University, in Halifax, Canada. Dr Doyle leads the IDRC project that supports the fish genetics network in Asia. Both are active in research and teaching at Dalhousie, in addition to their network activities. The above article is a longer version of one published in NAGA, the ICLARM Quarterly.



Dr Cesar Villegas checks up on tilapia broodstock at the SEAFDEC research station in Tigbauan, Philippines.

Philippines have extensive coastal areas where seawater and freshwater come together. Because tilapia is a "euryhaline" or salinity-tolerant species of fish, such brackish waters could be used for tilapia culture. This would reduce the pressure to convert crop lands to aquaculture. Alternatively, lands where the soil is too saline for rice or other crops could be used to establish tilapia ponds.

Although tilapia can be raised in brackish water, it does not spawn under such conditions. One component of the network research in the Philippines is to develop a tilapia strain that will.

At the Philippine branch of the Southeast Asian Fisheries Development Center (SEAFDEC) in Tigbauan, Iloilo, Dr Cesar Villegas is crossbreeding *Tilapia mozambicus* (a brackish water species) with *Tilapia niloticus*. The goal is to transfer the salinity-resistance of *mozambicus* to *niloticus* without some of the less desirable characteristics of *mozambicus* — such as early maturing and small harvest size.

Like other tilapia geneticists, Dr Villegas has had some difficulties because the two species do not spawn at exactly the same time. Also, the different ages of the males and females that are paired for breeding often causes them to fight rather than flirt. These are the kinds of practical problems that the researchers in the Canadian component of the network, based at Dalhousie University in Halifax, Nova Scotia, are trying to overcome through the use of new techniques and designs of experiments.

Dr Villegas expects to have results useful to industry in five to seven years. Results from other projects in the network may come considerably sooner, however. During 1988, the Thai genetics group, under the technical direction of Mrs Supattra Uraiwan, will conduct extensive testing of several tilapia strains developed during the past several years at the National Inland Fisheries Institute.

As the tilapia industry has grown, breeding farms have not been able to supply either the quantity or the quality of "seed" needed. Farmers complain of poor survival rates for young fish, low growth, and low reproductivity (fecundity).

Thus, Mrs Zubaida Basiao and her colleagues are developing a genetic index to identify at

an early stage which fish will perform well according to these and other criteria.

Her research is being conducted at SEAFDEC's Binangonan Research Station in Laguna Lake — the largest freshwater lake in the Philippines. Access to the island station is by a motorized outrigger canoe which threads its way through a maze of fish pens and cages.

The weight and size of tilapia fry are monitored regularly and compared with vital statistics in the same fish at maturity. The idea is to be able to predict adult performance through indicators in juveniles. In addition, the fish are subjected to stresses found on actual fish farms, such as crowding and starvation, to test the general fitness of each strain.

Dr Rafael Guerrero, an aquaculture consultant to industry and the Philippine Government but not connected with the IDRC-supported network, says such efforts to improve broodstock quality are the "long-term key" to the development of the industry. But he questions the relevance of genetics research to an industry faced with vast aquatic resources, limited capital, and poor consumers. He recommends placing more emphasis on improved management and that a next phase of the network's activities be concentrated on extension of research results to industry. According to Dr Guerrero, genetics won't become useful to the Philippine aquaculture industry for another five to 10 years — when intensive management becomes more important.

Those working in the Asian research network

are more optimistic. They say aquaculture management and the biology of cultivated fish must be made to fit together much better than they do now. And to do this, management and genetics research programs must work together. "An alliance of this sort has led to a revolution in agriculture," says Dr Roger Doyle, of Dalhousie University, who leads the Canadian team involved in the network. "No one would waste time planting wild grapes in a modern vineyard."

He adds that modern genetics doesn't have to mean high-tech aquaculture management. The aim of the genetics network is to develop fish that are better for ordinary farmers, under artisanal conditions. "New strains of fish that grow faster on cheap feed or suffer less from disease represent a real increase in the ability of farmers to feed their families. And since the gains are biological rather than technological, they are not affected by inflation or other factors out of the farmers' control," says Dr Doyle.

The most visible results of the network will undoubtedly be the successful new strains developed. However, the network's most lasting achievements, say the Canadians involved in the project, will be the new methods for developing strains and the creation of an international pool of qualified geneticists working on the shared problems of aquaculture. ■

Mark Timm is a Canadian freelance journalist. He writes on Southeast Asian affairs for several North American, British, and Asian publications.

COAXING FISH TO BREED

DRUG-HORMONE KIT READY FOR COMMERCIALIZATION

The article on page 4 describes efforts to provide artisanal aquaculturalists in the Third World with better strains of fish. Such genetic improvement requires "closed" gene pools — ones that aren't constantly being altered by the addition of fish from wild stocks. If fish farmers are to rely on the new strains, then government and private hatcheries must be able to supply them regularly with young fish at a low cost. The article below describes a new technology that will help to ensure such supplies.

GERRY PORTER

A fish breeding kit developed by Canadian and Chinese researchers that will make aquaculture less expensive and more efficient is ready for commercialization.

The kit is based on research by Dr Richard Peter of the University of Alberta and Prof. Lin Haoren of Zhongshan University of Guangzhou (formerly Canton), China. It uses drugs and synthetic hormones to solve an age-old problem of fish farmers — the reluctance of fish to breed in captivity.

"In aquaculture where fish are raised generally at quite high densities," explains Dr Peter, "they don't have the proper environmental cues for reproduction to occur naturally."

The scope of the problem can be seen in the Chinese example. With a 3000-year history of aquaculture, Chinese fish farmers cultivate more than 10 million hectares of ponds, rivers, and paddies. In 1984, they produced about 185 million tonnes of freshwater fish. In Guangzhou province, cultured carp are the main source of animal protein.

A perennial problem had been the time-consuming process of collecting enough fry and fingerlings from rivers, streams, and lakes to stock the ponds. But since 1958 the Chinese have induced spawning by injecting the mature fish with either the hormone HCG (human chorionic gonadotropin) — found in the urine of pregnant women — or extracts from the pituitary glands of carp. These materials, however, have poor shelf lives and are difficult

to obtain. At a single large hatchery in China, as many as 80 000 carp are killed annually to provide extracts for brood stock spawning.

"That is a lot of people involved in the whole production and a lot of fish they have to sacrifice," says Dr Peter.

Canadian researchers, including Dr Peter, traced the hormone back to the brain. They determined that a hormone produced there, leuteinizing hormone-releasing hormone (LHRH), induces the pituitary gland to produce another hormone, gonadotropin, which in turn stimulates the sex organs of male and female fish.

Dr Peter was working at trying to induce ovulation in goldfish, close relatives of carp, by using synthetic "analogues" or modified LHRH. But he wasn't successful using the analogue alone.

"The significant breakthrough was the work by a graduate student in my lab," says Dr Peter. The student discovered that another brain chemical, dopamine, was inhibiting the release of gonadotropin. From that basic idea, Dr Peter and his researchers explored a whole range of drugs to determine which acted best as a "dopamine antagonist".

"When we found that out, we went back to trying to induce ovulation in goldfish first of all, and found that it worked very nicely."

Prof. Lin Haoren met Dr Peter in 1979 and spent 1980 and 1981 working in Dr Peter's lab on regulation of gonadotropin secretion. It was after Prof. Lin returned to China that the dopamine connection was discovered.

With support from IDRC, Dr Peter and Prof. Lin initiated a three-year cooperative project in 1984 to test the method on Chinese carp. "It became very realistic then to apply this system to various Chinese carp to confirm that this inhibitory dopamine system existed in a wider range of species," said Dr Peter. Back in his own lab, Prof. Lin "did some nice basic work to demonstrate this."

Prof. Lin tested grass carp, common carp, mud carp, loach, and bream. Results showed that injections of LHRH analogue alone increased levels of gonadotropin in the blood, but were relatively ineffective in inducing ovulation. But injections of LHRH analogue and the dopamine antagonist, a drug called pimozide, at the same time resulted in a higher rate of ovulation.

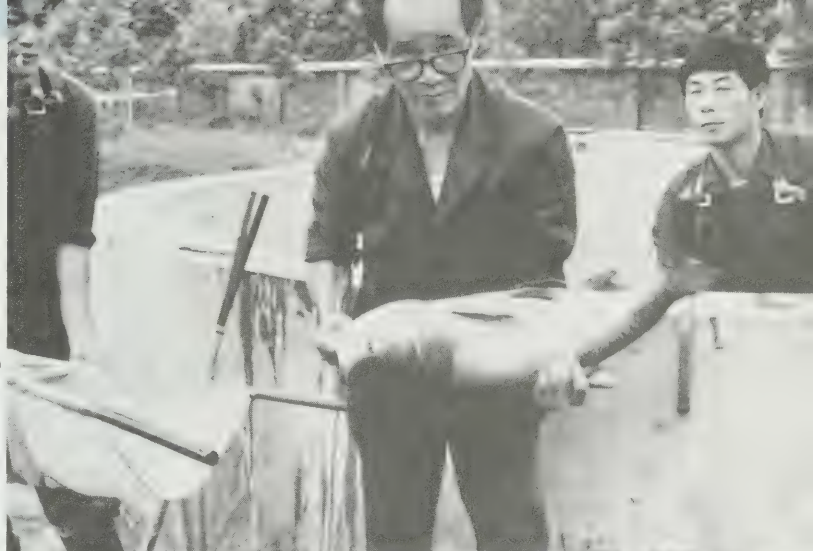
"We've taken the research to the point where we've demonstrated the different dosages you have to use for the drug," said Dr Peter. "Lin Haoren has set up field trials in fish hatcheries. That's very important because in addition to demonstrating that you can do this with large numbers of fish, having the cooperation from fish hatcheries really is the key to acceptance of the procedure. The fish farmers don't want to risk losses of their brood stock."

The kit will consist of a vial of LHRH analogue, a vial of dopamine antagonist, and saline solution, along with the syringes necessary for giving the two injections in rapid succession.

"I think this new method will greatly simplify the whole procedure," says Dr Peter. "The compounds are very stable and very predict-

Top to bottom: Zhongshan University technician in Guanzhou, China, holds specimen of one of several species of carp whose reproductive cycles have been brought under control; student working on project shows vial of hormone solution ready for use; hormone is injected into carp; eggs are squeezed from a grass carp 10 hours after injection.

Photos: Andrew McNaughton / IDRC



able. So it will change a lot of the work habits on fish farms." He adds that it is important "to market the kit at an affordable price."

A major advantage of the method is that the brood stock need only be handled once to inject them with the two substances. With other techniques, two handlings are required, increasing the risk of damage to the fish or disease.

For many fish farmers, low cost and convenience will be the main attraction of the method. "A lot of fish farms in China and elsewhere don't have the luxury of having other farms to raise carp to kill to make a pituitary extract. They have to buy it," says Dr Peter.

"We have tested this thing out on African catfish which is becoming more popular in China. The technique has actually been used in commercial production of catfish fry in Europe. It's being used for carp fry production in Poland, and it's been tried on the loach which is becoming commercially important in China. And I'm getting calls from U.S. breeders of aquarium fish."

The system, he says, will be particularly valuable in the tropics, where fish grow fast because of the warm waters and where millions of people are in need of protein-rich foods of high quality. ■

EDUCATION: HAITI'S ELUSIVE DREAM

ROBERT LANDRY

It's early. The quiet wretchedness of Poste Marchand neighbourhood in Port-au-Prince, the capital of Haiti, is not yet cloaked in damp heat, dust, and exhaust fumes. The women who sell fruit and secondhand clothes spread out the contents of their baskets before squatting down on the sidewalk of Borgella Street.

As the neighbourhood comes to life, it is a morning like any other — except for six-year-old Jacques Cadet who has just come out of a narrow garbage-strewn passageway.

This morning Jacques Cadet is starting out on a new life — one month later than other children his age. He is finally going to skirt the debris of Borgella Street, walk a little further, and go to school. His mother was a little late coming up with the CA\$65 needed to cover registration, the first month's school fees, and the cost of the uniform (two shirts and two pairs of pants), book bag, lunch box, and school books. She still doesn't have the \$10 per month to cover the rest of the school year, but she is optimistic: "I'll get it. I'll manage somehow." Excluding lunches, the total cost of sending Jacques to school for one year is about \$150, almost half of Haiti's reported per capita annual income of \$325.

In Haiti, public schooling is free, except for school supplies. Why, then, should Jacques, the oldest of three Cadet children, go to a private school, the cost of which is exorbitant for a single-parent Haitian family? "Because I want him to succeed" is his mother's answer. In a country where only 4 percent of the children registered in primary school ever finish their studies and only 2 percent get through high

school, such a hope seems unattainable, an elusive dream.

Haiti is a cruel caricature of the problem of school failure in the French-speaking Caribbean, something which since October 1985 has been the subject of research partially funded by IDRC. Four institutions are cooperating on the project: the Université d'État d'Haiti, the Martinique and Guadeloupe campuses of the Université Antilles-Guyanas, and the Centre de recherches caraïbes at the University of Montreal.

Haiti is the poorest country in the Western Hemisphere and 80 percent of its people are illiterate. By contrast, Martinique and Guadeloupe, which politically are part of France, have a literacy rate of 90 percent and France continues to provide large sums of money, particularly for public education.

Is any comparison possible? "The problem of school failure comes up in different contexts, but we hope to find a common denominator," says Dr Chavannes Douyon, a psychologist and professor at Université d'État d'Haiti.

"So far, we are only discussing hypotheses," says Dr Douyon. "The objective data on school failure have still to be compared; the interviews with parents, children and teachers are only just beginning. Still, our hypotheses are beginning to prove out."

First there is the culture gap hypothesis. As in Martinique and Guadeloupe, the schools in Haiti are resolutely French, despite a number of attempts in Haiti to make them more Creole. Everything about the Haitian children's life is Creole except schooling. Classroom instruction in French, sometimes repeated impatiently in Creole, is difficult for the children to understand.

Schools nevertheless place the speaking of good French above all else. This bilingualism, or linguistic dichotomy as the experts call it, clearly favours the children of the Haitian elite which has undergone acculturation.

The lower rate of failure in the schools run by the clergy and attended by the Haitian elite supports this hypothesis, according to Dr Douyon. The French system prizes rote learning rather than genuine understanding of a language and values.

Jacques Cadet's mother gets angry if people talk to her about schools where classes are taught in Creole. "I've had to put up with enough because I don't speak French properly," she complains. School, even if it is "foreign", is highly prized in the Francophone Caribbean. It represents the door to social and financial success.

However, there are a great many failures. This is what gives rise to the socioeconomic hypothesis of which Haiti, once again, is an extreme example.

Public schools are free and parents are obliged by law to send their children to school.

Life, though, isn't free and the law is never applied. If children are to fail in school, they must first get into it. For the rural population this is a challenge. Where schools do exist, they are often a long way off. And given that rural annual incomes average only CA\$156, school clothing and supplies are simply out of financial reach. The oldest or most promising children may go to school, but at a late age, sometimes 14 or 15, when another child becomes available to take over their work in the fields or the marketplace. Only 14 percent of school-age children in rural areas of Haiti attend classes, all of them in primary schools, none in secondary.

School is an obstacle course. If the daily distance barrier can be overcome, then there are money and language problems to cope with. Another obstacle is the low level of cultural stimulation that can be offered by families in which four out of five members are illiterate.

The results of research into school failure in the French-speaking Caribbean are somewhat predictable. Even if the researchers were to examine only that part of the Haitian population which actually attended school, the failure rate would be higher there than in other islands because of the country's socioeconomic problems.

Each of the teams has been obliged to come up with its own approach. In Martinique and Guadeloupe, the official presence of France is evident in the substantial administrative and financial contributions, and private schools play only a minor role. The research teams on those islands will therefore focus on social disparities, social adjustment problems, and cultural problems when gathering qualitative data, that is, personal impressions and anecdotes of interviewees. They will also keep in mind that Martinique and Guadeloupe have technical and trade schools which can soften the impact of school failure.

The Haitian team has a heavier task. Quantitative data (such as numbers and ages of children enrolled in school) aren't centralized and the schooling problem itself comes up at two levels. First, there are schools that simply can't accommodate the number of children they are supposed to. Then, within the system itself there are high failure rates among pupils.

Despite these hurdles, the Haitian research team hopes its report will help to restart the rather timid school reform begun a few years ago. "But it's a reform which can't be effected unless there is reform of the social and, above all, the socioeconomic structure of the country," says Dr Douyon. "One can't separate the problem of schools from the general problems of the community as a whole." ■

Robert Landry, a Canadian freelance journalist based in Montreal, has visited Haiti several times since January 1986.



Photo: Robert Landry



Respected taleb with pupils. Unfortunately, traditional Islamic teaching and modern Moroccan education are worlds apart.

enough to work in the fields. The especially gifted remain until they have learned the entire Koran. No pupil in the M'sid is older than 15 or 16.

A Moroccan sociologist, Ahmed Zougarri, professor at the Hassan II Institute of Agriculture and Veterinary Sciences, is currently studying Koranic schools in a project funded by IDRC. "The M'sids and the taleb are important elements in the education of Moroccans," says Mr Zougarri, "and therefore a method must be found to help the taleb perform his functions."

One might assume that Koranic schools prepare children for primary school and that there is close cooperation between traditional and modern schools. Unfortunately, this is not the case.

In Koranic schools, up to 40 children are jammed into a small room three or four metres square. The pupils are split into three levels according to how long they have been studying in the M'sid. As the days pass, they learn verses of the Koran which the taleb believes do not require explanation. Although the children may know how to read and write the verses on the wooden tablets, many in fact do not understand their meaning.

Neither the taleb nor anyone else teaches the children arithmetic. Villagers consider it more important for their sons to know how to perform their ablutions and prayers than to read, write, and count.

Mr Zougarri, who concentrated much of his research on the relationship between the teachers and villagers in rural Morocco, found that the latter distrust the modern schools and see no benefit in them. Both the school and its teacher are seen as intruders because it is not the villagers who select them. Not only are school and teacher imposed on the villagers, but they bring a lifestyle and a manner of thinking much different from theirs. The requirements and demands of city life are transplanted to the villages (many of them isolated) without any regard for the socioeconomic and cultural conditions prevalent in rural Morocco.

To register their children in these unwanted modern schools, rural people must incur expenses well beyond their means. If they want their children to succeed, they must also help them with homework and studies. That, of course, becomes impossible because the parents themselves are illiterate and can't afford tutors.

What sometimes happens is that rural people register their children in the modern school to show good will, then take them out after four or five months because of financial hardship. It is not surprising, then, that over 70 percent of the population in Morocco today is illiterate.

Koranic schools have the potential to become a major force in the fight against illiteracy and to stimulate a progressive dialogue among rural Moroccans. As long as the people see no need for modern education, however, the Koranic schools will continue to be ignored by the authorities and will remain an untapped educational resource. ■

Fatima Bekkhar is a Moroccan journalist. In 1986 in Tunis, she participated in a training workshop organized by IDRC for French-speaking science writers from North Africa.

MOROCCO'S KORANIC SCHOOLS

FATIMA BEKKHAR

Sitting cross-legged on mats in front of the teacher, the children sway back and forth as they recite in droning tones the verses of the Koran. The younger ones mouth the words of the older children who struggle to decipher the verse written on the wooden tablets held in their laps. The scene is typical of the "M'sid" or Koranic school usually found next to the mosque in all villages of rural Morocco.

At the end of the harvest season, the villagers launch a search for the "taleb" — the person who will teach their children the Koran and the basics of Muslim religion. The search is not easy. The villagers cannot choose one of their own as taleb because it is difficult to dismiss a fellow villager if the need arises. A taleb who is married cannot bring his wife and children to live with him in the village — a restriction aimed at avoiding possible disagreements between his family and the villagers.

Other qualifications are equally tough because a good taleb is more than a teacher

of the Koran. He plays an important role as adviser to the villagers and therefore must remain neutral on all village issues. The villagers not only question him on religious matters but also discuss with him their worries, fears, and wrongdoings, seeking answers and reassurance from him.

Once the taleb has been selected, the villagers make an agreement with him regarding payment. Usually he is given local produce such as grain, barley, almonds, or corn instead of money. He is provided with accommodation close to the school and is fed by the families of the village. Sought after by everyone in the village, the taleb has an abundance of choices as to who will be his host on any given day. Every Thursday, on the eve of communal prayer day, and every feast day, each pupil gives the taleb one or two dirhams (Moroccan currency) as token wage.

Together with the parents, the taleb is responsible for the education of the children. Most youngsters attend the M'sid beginning at age five and leave as soon as they are old

BETTER BURNING LIGNITE

FOR TURKEY'S STEEL MILLS



Photos: Robert Charbonneau / IDRC

ROBERT CHARBONNEAU

Chimneys spew out their smoke and freighters in the port are ready to unload tonnes of iron ore from Brazil and coal from Australia.

Iskenderun, on the Turkish coast, 110 kilometres to the south of Adana near the Syrian border, was but a small fishing village in 1970. Today, it houses the state-run ISDEMIR, the third largest steelworks in Turkey, which employs 13 000 workers and produces more than 2.2 million tonnes of semi-finished steel yearly.

A little white car winds its way under the 40 kilometres of conveyors connecting the grey buildings. In the vehicle is Gaye Erbatur, accompanied by her husband Oktai, who is

driving. Both are chemists and teach at the University of Çukurova, on the outskirts of Adana. Mrs Erbatur heads an IDRC-supported project aimed at upgrading lignite, a low-quality brownish black coal, and finding ways to use it in the Turkish steel-making industry. Upgraded lignite will help to save on metallurgical coke.

Every day, each of the four blast furnaces uses 1190 tonnes of coke, the essential fuel for smelting ore. Coke is obtained by distilling bituminous coal (high-quality coal) in a vacuum, where the volatile substances are released. It provides an intense heat energy and is able to withstand compression in the blast furnaces, where it is placed between the layers of ore to be smelted.

All the coke is made on site from imported coal purchased on the international market at a cost of more than CA\$143 million a year. This is an expense the Turkish government would like to reduce in order to improve the country's balance of payments position.

There are no deposits of high-quality coal in Turkey. Several lignite deposits, however, have been mined in the north and west of the country for use in thermal power plants or for local heating requirements. If lignite, which is a crude form of coal still containing vegetable matter, is to be used in steel making, it will be only the highest grades that are selected for processing.

Dr Esteban Chornet, of the chemical engineering department at the University of Sher-

Left, technician Senel takes a reading off the prototype reactor used to upgrade the lignite. Right, gases used in the process are analyzed by means of a gas chromatograph. Bottom, the ISDEMIR steelworks at Iskenderun, Turkey.

brooke, in Canada, has developed a technique for converting oxidized coal (which produces less heat than unoxidized coal) into metallurgical coke. The process, developed in cooperation with the Canada Centre for Mineral and Energy Technology (CANMET), is now being patented. Combustion characteristics are improved by placing the coal in a pressurized container (called an autoclave) with water and carbon monoxide.

Gaye and Oktai Erbatur want to adapt this technology to upgrade local lignite. As a first step, these researchers have installed instruments in their university laboratory for analyzing the composition (content of carbon, hydrogen, nitrogen, oxygen, and sulphur) of lignite samples from seven sites in Turkey. Since only the best lignite in the country can eventually be used to help reduce current consumption of coke, this first identification stage has been of major importance.

Next, the researchers hired a young engineering technician, Gjhan Senel, to carry out the laboratory experiments at ISDEMIR. The steelworks authorities cooperated from the beginning of the project in 1984, explains Mrs Erbatur.

The upgrading process uses gases produced by the blast furnaces, but the composition of these gases sometimes varies. For the research team's tests to be realistic and accurate, it was therefore necessary to install a small prototype reactor capable of upgrading the lignite on the actual steelworks site.

Abdullah orban, director of research laboratories and procedures at ISDEMIR, assisted in the experiments. The researchers were offered space and the cooperation of the plant work crews. ISDEMIR also provided the precious gas necessary to fuel the reactor.

The reactor was built in Canada by the Montreal firm THP according to plans supplied by the University of Sherbrooke, and shipped to Iskenderun in Turkey.

The reactor's purpose is to increase the carbon content of the lignite. It is loaded with

1.5 kilograms of lignite with a carbon content of about 75 percent. The operation increases that proportion by 5 to 8 percent so that the lignite can be used in the steel-making process.

The material is first heated to between 350 and 400 degrees Celsius with gas reclaimed directly from the blast furnaces. The active element, for the purposes of upgrading lignite, is carbon monoxide, constituting from 21 to 24 percent of the gas.

The gas is pressurized to about 2000 pounds per square inch (20 megapascals) before reaching the raw lignite. Only the pressurization process consumes energy, as the gas arriving from the blast furnaces is already very hot. This gas is normally used to heat the steelworks and will continue to be used for this purpose since it is not consumed in the upgrading process.

From a technical point of view, Mrs Erbatur would have preferred to use the gases released from the coke ovens rather than those from the blast furnaces because the former are much richer in carbon monoxide. The valuable coke oven gases, however, are already spoken for — they are sold as by products on the market. The gases from the blast furnaces, on the other hand, have no commercial value so it is these that ISDEMIR and the researchers have favoured.

At present, Mr Senel, the technician who operates the reactor, carries out two or three complete upgrading experiments weekly. Each takes two to six hours, with measurements taken at regular intervals. The treated lignite and the gases are later analyzed in the lab. The carbon content is assessed and the composition of the incoming and outgoing gases is also evaluated by means of a chromatograph supplied to the researchers as part of the project.

The reactor is a veritable bomb. The presence of gases under pressure and fuel "makes the operation perilous" and, says the technician, "the cleaning tedious." "Above all, it is very important to clean the conduits thoroughly in order to avoid pressure buildups."

Although the experiments are just beginning,



Mr and Mrs Erbatur are confident they can put a certain proportion of the upgraded lignite to good use. "The process developed with the help of Canadian technology is going to help us to use local lignite in the manufacture of steel. We will always need imported coal, but we can make better use of lignite in the Turkish steelworks," says Mr Erbatur. The upgrading process may even be useful in modifying the lignite burned to heat buildings.

Will the process be economical for such a purpose? The researchers are still silent at this stage, but they claim that energy shortages recently led the government in the capital, Ankara, into highly questionable expenditures. During the winter of 1986, half of Ankara suffered from the cold because of an energy shortage. The government therefore imported expensive anthracite (high-quality coal generally used in blast furnaces) and subsidized its use in city homes. Not only did this decision have adverse economic consequences, but it also led to increased air pollution.

Turkey's lignite will not solve all its energy problems. While coal and oil will still have to be imported from abroad, the researchers are hoping that the adaptation of Canadian technology will amplify and diversify the uses of a local resource. ■



PUTTING THE SQUEEZE ON OIL PALM

DENIS MARCHAND

In Cameroon and other West African countries, palm oil is widely used in cooking. The traditional oil extraction process practised by villagers is a common sight in the country's rural areas. In 1981, production of palm oil in rural Cameroon was about 12 000 tonnes — 18 percent of the recorded output of the three largest urban-based refineries.

The harvesting and processing of oil palm fruit using traditional methods are a long and exhausting process. "It's even dangerous," says the headman of a village located 80 kilometres southeast of the capital, Yaoundé. "Every year men fall accidentally or get bitten by poisonous snakes when they climb up the palm trees to cut off the clusters of ripe fruit. Now the young men increasingly refuse to climb the trees. Besides, the money to be made from it isn't much."

Despite the difficult work and small profits, the four families that make up the village get right down to business as soon as the fruit is ripe. As much oil as possible has to be extracted to meet domestic needs and make some money from the sale of the surplus.

The women spend several hours breaking up the clusters of palm fruit gathered by their hus-

bands the day before. This painstaking and boring job doesn't prevent them, however, from carrying on with their domestic tasks. They continue to look after their children, prepare meals, and supply the household with water.

Once the clusters have been pulled apart, the fruit is placed in a 200-litre barrel with some water and cooked for about seven hours. The next step is to extract the precious oil. The women and children pound the fruit with a pestle to remove the outer shell. To separate the soft oil-bearing pulp from the hard nut in the middle, the fruit is mashed, while it's still hot.

Continued mashing of the pulp squeezes out the oil. In some regions, villagers do this by trampling the pulp underfoot, sometimes burning themselves badly. In this village, though, a press made of logs is used for the operation.

With traditional methods, unfortunately, much of the oil remains in the pulp. The yield per 200-litre barrel of fruit is up to 20 litres of crude oil.

Once extracted, the unrefined oil is boiled down and filtered to clarify it, and then bottled.

Despite the disappointingly meagre output of their work, the small rural producers are full of hope because of the efforts of a national machinery-development agency to provide some technical solutions. CEENEMA (which stands for the French name Centre national d'études et d'expérimentation du machinisme agricole) is linked to Cameroon's Ministry of Agriculture. With IDRC funding, it has been at work in recent months developing a press similar to one known as the Colin. Imported from France, the Colin has been successfully used by a number of small firms in Cameroon.

"The cost of this manually operated imported machine is too high," says Jules Tetka, an officer with the research project. "That's why CEENEMA is now trying to simplify the device and reduce the construction cost. We're also thinking of manufacturing the presses in Cameroon. Our research is concentrated on modifying the size of the pulping screw and the number of gears required to operate it."

Simplifications have already been made. The CEENEMA prototype now has only one screw and four gears and is able to pulp and press several kilos of oil palm fruit in a few minutes. The Colin press, on the other hand, has two screws and seven gears.

So far, the research effort has doubled the quantity of oil that would be obtained from the same quantity of fruit using the traditional method. It has also cut the heating time in half, which saves firewood.

Technology like this may finally make palm oil processing a profitable activity for Cameroon's rural people. ■

Denis Marchand is a Canadian photographer and journalist based in Montreal, Quebec.

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Photos: Denis Marchand



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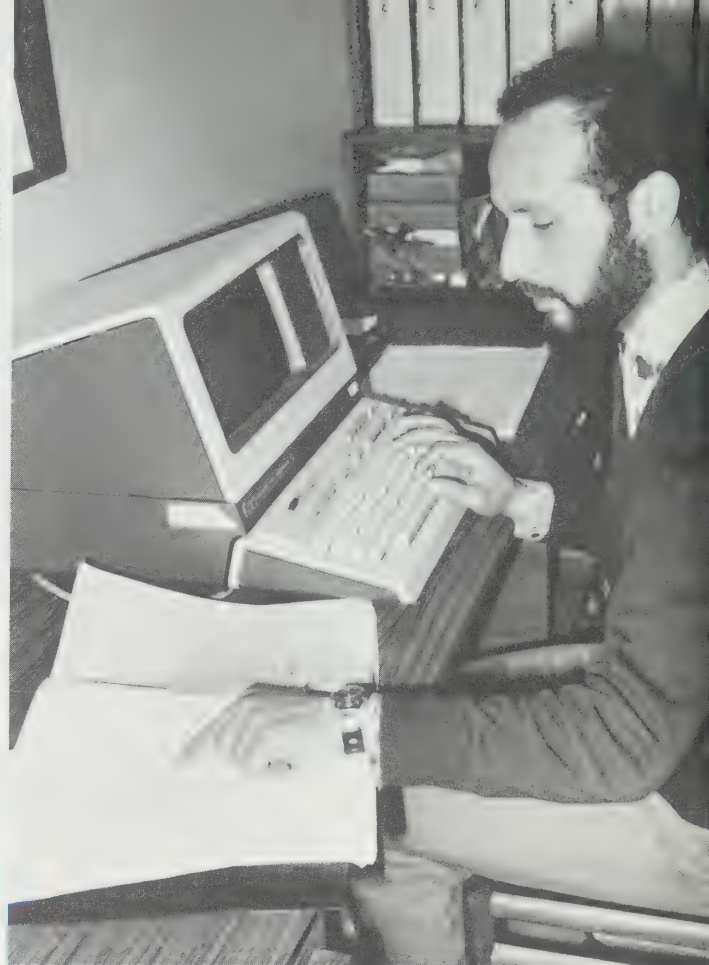
6.

1. It takes three women almost three hours to pull apart 200 litres of palm fruit clusters. 2. The fruit is then cooked and pounded, an exhausting job. 3. Everybody, including the children, works at removing the hard palm nuts from the pulp. 4. To extract the oil, a bag of pulp is squeezed between two logs. 5. The oil is poured into empty pop bottles and sold by children at the roadside. 6. Above, Jules Tetka, with the CEENEMA press being developed for small-scale palm oil producers.

TOO MANY SCHOLARS, NOT ENOUGH JOBS

The Tunisian government frowns on emigration in general, yet encourages university graduates to work abroad on cooperative technical projects. Such foreign assignments help bring foreign currency into Tunisia. Unfortunately, both kinds of exodus adversely affect the quality of the country's pool of human resources.

Photo: Neill McKee IDRC



Poor prospects for a challenging job induce many educated Tunisians to emigrate to greener pastures.

MONCEF MAHROUG

“I just couldn’t take it anymore,” explains a Tunisian specialist in library science who did his undergraduate studies in England. “With no career prospects in sight, I explored possibilities with the American Embassy and was lucky enough to qualify for a scholarship to study for my PhD in the United States. I don’t count on returning here (Tunisia) after my degree.”

Because his position at the Ministry of Cultural Affairs is not one the ministry had originally recognized any need for, he is stuck doing a job for which he is overqualified.

Although Tunisia is not as badly affected by the brain drain as some of its Arab neighbours, it loses many of its senior level professionals to France, the United States, and Canada every year.

From 1945 to 1975, over 150 000 Arab scientists and other professionals from the region emigrated to industrialized countries. The United States attracted the lion’s share of this brain pool. Between 1966 and 1977, for example, 5794 scholars mainly from Egypt, Lebanon, Iraq, and Syria emigrated to the United States. In the same period over 500 Tunisian professionals came to North America.

A recent IDRC-funded study carried out by Youssef Alouane of the Institut national du travail et du service social de Tunisia (the Tunisian National Institute of Labour and Social Services) indicated that many of the university graduates who leave the country complete their studies abroad. The study asked Tunisians who have settled in Europe, North America, and the Middle East to anonymously explain their reasons for leaving.

Tunisians who return with university degrees from abroad often find life at home difficult and disappointing, according to the findings of the study. Hamadi Lâajimi is a typical example. Having succeeded in becoming a sports commentator with the British Broadcasting Corporation, he returned to Tunisia several years ago to try and carve out a future for himself in radio. He left again recently — but this time he says he will not come back.

Most returning Tunisians make the decision

to emigrate again before the shock of the return home wears off. “I could not afford to be unemployed for long, so as soon as I saw there were no job opportunities, I left,” confides a physics lecturer. “I have few regrets.”

Others do not even try to find jobs because they realize that Tunisia has no requirement for their field of expertise. Such is the case for a nuclear physicist now living in Vienna and also for an aerospace expert who worked on the Apollo 12 project.

The brain drain from Tunisia is perhaps best described by a specialist in kidney diseases who has studied and worked abroad: “There is no coordination between the needs of Tunisia and the education system, which is too slanted toward the requirements of a developed country. To put it in a nutshell, we produce too many engineers and too few specialized tradesmen.”

Sometimes, of course, returning graduates have no trouble finding work and fitting in. Despite their initial positive attitude, however, they often become discouraged. The scarcity of research facilities in Tunisia, the lack of equipment, and the shortage of properly trained staff have driven many scientists and other researchers out of the country.

One professor, invited to join the staff of the Pasteur Institute in Tunis, declined the invitation and instead took a senior position with the Pasteur Institute in Paris. “I don’t need a villa or a chauffeur-driven car,” he says. “What I do require is a well equipped laboratory in a stimulating university environment.”

In Tunisia, people sometimes emigrate for political reasons too. Says a Tunisian theatre personality: “To leave is to regain the ability

to speak freely. It means abandoning a ghetto where speech must be approved by a censorship committee.” A teacher of sociology confirms the importance of political affiliation: “Government people have a general tendency to look at the political stripe of a person rather than at his education or technical ability.”

It is rare that a graduate is swayed by financial offers to leave Tunisia. However, just the opposite is true of Tunisians posted by the Tunisian government to work in Arab or African countries for two- or three-year terms. The majority of such cooperants, who now total nearly 1600, chose to be posted in order to be able to get married or buy a car or housing.

Although there is little doubt that the brain drain in Tunisia lowers the quality of the country’s human resources, it is not surprising that the government plays a role in this phenomenon by encouraging graduates to leave on temporary cooperative assignments. The fact is that the number of graduates in a variety of fields exceeds the available positions. Ironically, however, encouraging graduates to leave the country can sometimes suddenly create a shortage of personnel in certain professions. Last year, for example, X-ray technicians were prohibited from leaving the country because for a change there was an excess of jobs instead of candidates.

In the meantime, the permanent emigration of other individuals in search of a better life removes the equivalent of more than CA\$4 million every year from Tunisia’s economy. ■

Moncef Mahroug is a Tunisian freelance journalist.

PRIMING THE PVC PUMP

GERRY TOOMEY

The University of Malaya in Kuala Lumpur, Malaysia, will soon become a crossroads for water engineers, technicians, manufacturers, and community development workers from around the Third World. Their purpose: to learn all about village handpumps, especially how to build them.

The university's department of mechanical engineering is gearing up to open a research and training centre in all facets of handpump technology and use — from manufacturing, testing, and installation, to financing, community organization, and pump maintenance. IDRC will provide just over CA\$1 million to set up the centre which is expected to be fully operational by May.

The new facility will be aimed primarily at Third World manufacturers — both nonprofit community groups and private commercial enterprises. It will help them to establish workshops and factories for producing a low-cost, easily maintained handpump that incorporates plastic components.

Backing up the centre's on-campus services will be an international "telematics" network for the timely sharing of technical information. This will link other IDRC-supported pump research projects around the world with the training centre via computerized communications. It will be possible for a handpump researcher, say in Costa Rica, to define some technical difficulty using computer graphics and then transmit it to Kuala Lumpur. Experts there will be able to work on the problem and then transmit an answer back.

The new centre is IDRC's first major step in promoting the widespread manufacture and use of the plastic pumps it has helped to develop over the past 12 years.

It was in 1978 that the University of Waterloo in Canada put the finishing touches on a handpump prototype designed for shallow wells. That project was funded by IDRC. The same year, IDRC launched a network of research projects to test the low-cost handpump's performance in several Asian and African countries.

The main innovation of the Waterloo design was the use of polyvinyl chloride (PVC) plastic for the below-ground components such as the piston, foot-valve, and riser pipe. This tough and inexpensive plastic, increasingly

used in home plumbing, is widely available in both the industrialized and developing countries. It's easier to work with than cast iron because parts can be made by injection moulding and glued together rather than welded. And unlike cast-iron parts, PVC doesn't rust. The water it delivers, therefore, tastes and smells better.

Researchers in Malaysia, the Philippines, Sri Lanka, Thailand, Ethiopia, and Malawi field tested the pump to determine whether it could be adapted to local conditions — namely to the skills, materials, and water-related customs found in each country.

In the end, the projects in Sri Lanka, Ethiopia, and Malaysia yielded the most concrete results: three variations of the Waterloo design, the most promising one — the Unimade — designed by Dr Goh Sing Yau at the University of Malaya.

In a second phase of the IDRC program, begun in 1982, projects were launched in six countries to field test and modify the new designs. The projects are at various stages of

development, and two other proposals, from China and Kenya, are now under negotiation.

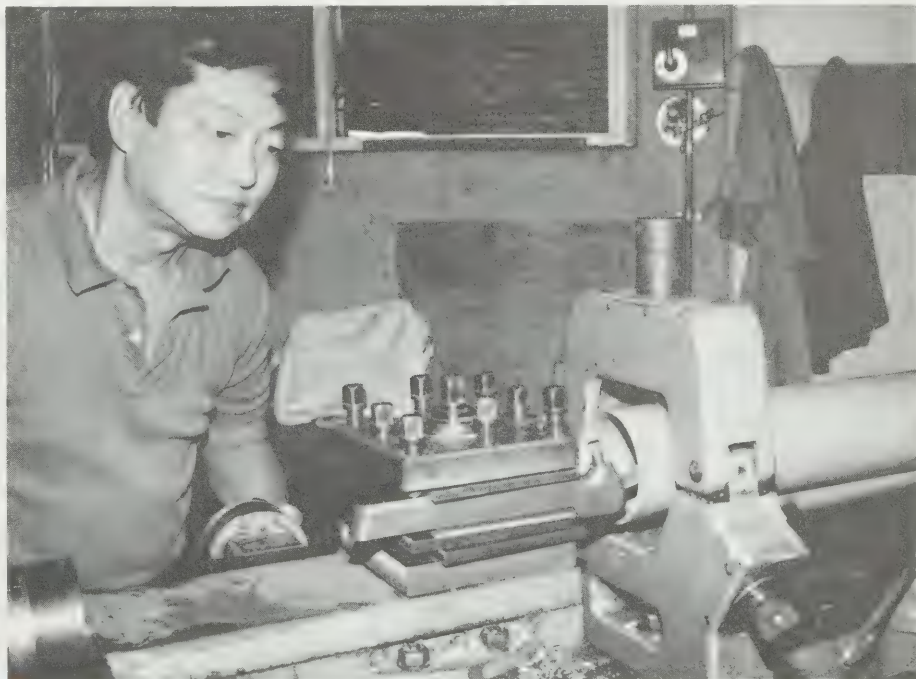
The Sri Lankan and Ethiopian teams are each improving their own design. The others are all working with the Malaysian Unimade. In effect, the Malaysian project, because of the technical expertise of Dr Goh and his associates, has been serving as the hub of the network. This know-how will be further shared via the new training centre.

To modify the pumps properly, researchers in the international network are having to examine a number of people-related aspects of the technology. For example, how well is it accepted and understood by villagers? Is it economically viable? How can people pay for it? Can it withstand the intense stress of day-to-day use? (See article on Philippines, next page.)

Most of the second-phase pump projects are being carried out by nongovernmental organizations (NGOs) because of their wealth of experience in rural water delivery.

The researchers are also looking into the

Photo: Gerry Toomey / IDRC



Gearing up to pass on the manufacturing know-how: A technician at the University of Malaya machines plastic parts for the Unimade handpump.



Dr Goh Sing Yau

most suitable arrangements for fabricating the pump in their own countries. The Sri Lankan team, part of an NGO called Sarvodaya, has made much progress in manufacturing its SL5 handpump in small workshops run entirely by women. The program's success to date has prompted Sri Lanka's National Water Supply and Drainage Board to order 225 pumps, and UNICEF has asked for 300.

This is only a beginning. Negotiations are now under way for IDRC and the Canadian International Development Agency to assist in a major expansion of Sarvodaya's operations to Sri Lanka's southern dry zone. A total of 120 women in 60 workshops will be trained to manufacture, install, and repair the pumps.

In Malaysia, injection molding of plastic parts has been successfully used to mass produce some 4000 Unimade pumps, both for Malaysia's domestic rural needs and for the rest of the projects in the IDRC network.

For those researchers now field testing the Unimade Mark IIs and IIIs in their own countries, the issue of pump fabrication is not so much one of actual manufacturing technologies such as injection molding and jig design — the Malaysians have already perfected these. Rather, the researchers need to know how manufacturing operations can best be organized and managed in their own countries. For example, how much of the work can or should be subcontracted out and how can quality control be ensured?

As the various projects advance into the manufacturing phase, the new research and training centre in Malaysia will provide the solid technical backing they need. Eventually some of the participating projects may themselves become training centres to help neighbouring countries to profit from handpump technology too.

By helping to launch the new centre, IDRC is protecting its heavy long-term investment in handpumps and making the technology available to those who need it.

The promising technical results so far achieved must not be ignored or forgotten — like dusty old lab reports on a top shelf or rusty, broken-down pumps abandoned for lack of spare parts. Rather, they should be transformed into clean drinking water for millions of villagers. ■

WATER FOR THE BARRIOS

The Malaysian "Unimade" handpump is being put to the test in six countries. In the Philippines, it has caught the attention of water planners and politicians alike, including the President, Corazon Aquino.

During the oppressively hot Philippine summer which begins in April, the province of Camarines Sur becomes a parched land. Farmers shimmer like mirages in their now barren rice fields. Few people venture out into the midday sun, preferring instead the shelter of mango or coconut palm groves. And water becomes a precious commodity.

In the "barrio", or township, of Santa Elena Nabua, the family of Salvacion Regalado used to get drinking water directly from the rice fields. But with the growing use of agricultural chemicals, the water became contaminated, so they collected rainwater in a simple hole in their backyard, which unfortunately dried up in summer.

The people in these and other communities in Camarines Sur still use water with great respect during the dry season. However, supplies are becoming more reliable, accessible, and safe for some of the families due to the installation of handpumps made with plastic components and designed with the special needs of villagers in mind.

Clean water is one of humanity's most basic needs. Yet three-quarters of people in developing countries do not have access to adequate potable water. In the Philippines about 60 per cent of the rural population is without access to safe water.

IDRC has supported handpump research and development for 12 years (see previous article). The testing of pumps in barrios of the Philippines is just one component of an international network of IDRC projects to record pump performance and villagers' reactions to the designs so far developed. These projects are also investigating which types of community participation ensure fair sharing of the water and correct maintenance of the pumps, and which approaches to manufacturing best match local conditions.

In the Philippines, field trials of a Malaysian-developed pump, the Mark II Unimade, began in 1984. The University of Malaya in Kuala Lumpur, Malaysia, provided the guts of each pump — the piston, foot valve, and cylinder assembly. The above-ground components, namely the metal stand, cover, and wooden handle, were built by a Philippine technology centre.

Nationally, the project was coordinated by Philippine Business for Social Progress (PBSP), a nongovernmental organization with extensive experience in rural water projects and funded largely by local businesses.

In Camarines Sur, the main target area, the work was carried out under PBSP's supervision by the Naga City Social Action Center (SAC), a service arm of the local Catholic church. Pumps were given to small communities that already had a local organization in place to take responsibility for the project, or to ones prepared to form such an organization. Women played the major role in the project (see box).

In Barrio Santa Elena, Concepcion Regalado, the sister of Salvacion, was chosen as a project "monitor", the person responsible for pump supervision and maintenance. A pump was put in her yard because she was a member of a Christian farmers' self-help group.

When other villagers saw how easy it was to operate the pump — even for children — practically everyone wanted one of their own. But they were told they would have to pay part of the installation cost — an average of 1300 Philippine pesos (CA\$85). As no one had this sum available in cash, payments were arranged in several installments.

Some of the villagers were surprised. In the past, officials from Manila had given them such equipment but had never asked for anything in return but their support in the next election. Never had the intended beneficiaries been asked whether they thought the gift was suitable. Although such projects got off to an enthusiastic start, they often petered out. This was the expected outcome of such aid.

Asking the villagers to have a financial stake in the project was seen as a way to break out of this unprogressive cycle. "We have an agreement that any project like this will not be a dole-out, because the people are so used to dole-outs they don't know how to take care of themselves," says Monsignor Alberto Nero of the Social Action Center.

"We would like to uplift them by telling them that the repayment will be a help to other groups like them. The money will be used to finance other projects. They, being poor, will now be in a position to help other poor people like themselves."

In fact, the village handpump project was as much about building self-confidence and self-reliance among villagers as it was about developing a safe water source. Mediatix "Peanuts" Valera, leader of the Philippine pump project for PBSP, says water projects "can interest and motivate the villagers to develop cooperation and even foster unity among themselves."

This is not to say that the handpump project has been without technical hitches. Of the 27 Mark II pumps installed in Camarines Sur, only

President Aquino with Unimade handpump. Far right, mother and child in Camarines Sur — the real beneficiaries of pump technology.



Photo: Edison Dy Ong



Photo: Gerry Toomey IDRC

four performed flawlessly between September 1985 and March 1987. Outside Camarines Sur, four of the nine installed developed problems.

In some cases, bolts made of acetal plastic on the below-ground components have broken under the stress of use, indicating a manufacturing flaw. "You may get high quality acetal in Canada but not necessarily in developing countries," explains Prof. Goh Sing Yau, the engineer who piloted the development of the Unimade Mark I and II, as well as the latest version, the Mark III.

Another common problem has been worn piston rings. In locations where the well water is rather sandy, the rings have been wearing out more quickly because of abrasion and have sometimes damaged the walls of the riser pipes.

In Barrio Santa Cruz, the villagers responded to such problems with down-to-earth resourcefulness. When asked by some IDRC visitors whether spare parts were a problem, one responded, "Leave a pair of tsinilas (sandals)!"

Sandals? The pump piston rod was quickly pulled out of its casing and the riddle solved. To replace a piston ring, a round piece of a child's rubber sandal had been cut out and inserted in between two sections of the piston. As a temporary solution it did the trick nicely.

Reports of such problems by the villagers have been a crucial part of the research project. They have enabled Prof. Goh and his team in Malaysia to improve their product. The acetal bolts, for example, have been replaced with stainless steel bolts, which cost about the same.

Prof. Goh is also experimenting with rubber cup seals to replace the PVC piston rings. He notes that at each stage of the pump's development, the cost goes down. A Mark III, he says, could be sold for between CA\$155 and \$195 to be competitive.

The Philippine users of the handpumps have also learned something as a result of these technical hitches. They realized that they had to cooperate with the village project monitors in regular maintenance of the pumps. Immediate attention to even minor repairs was seen as important.

In September 1986, Philippine President Corason Aquino called on the country's business community to throw its support behind national development. PBSP's pump project with IDRC, in particular, had caught the president's attention and she asked the organiza-

tion to draw up a plan for rural water delivery using a variety of technologies — deep wells, springwater collectors, rainwater cisterns, and handpumps.

The result was the creation of a national, privately supported water agency called the Tubigan Foundation. With Tubigan money, PBSP proceeded to install 250 handpumps, including 50 of Prof. Goh's Unimade Mark IIIs.

On January 22, 1987, under the hot Philippine sun in a squatter settlement of Cabanatuan City, Mrs Aquino inspected a newly installed Mark III and pumped water with it. This was part of a ceremonial handing over of PBSP's water projects to the new Tubigan Foundation.

A few months later, Ms Valera was appointed executive director of Tubigan, recognizing the success of PBSP's work and her expertise in managing water projects. Very quickly her desk has become inundated with project proposals from both the public and private sectors.

Meanwhile, the organization that produced the Pilipino-language handbook for the Unimade Mark II pump — Kabalikat ng Pamilyang Pilipino — is now carrying out a marketing survey to determine the feasibility of manufacturing Unimade pumps in the Philippines. The study is supported by the Program for

Appropriate Technology in Health (PATH), based in Seattle, USA.

Ms Valera underlines the importance of such initiatives. "If the spare parts of the Mark II or Mark III are not available, then they will end up like all those other handpumps that are just considered junk," she says.

Most handpump technology fails, she adds, because it is too complex for the user who must call in a high-priced professional to repair it. In this regard, Ms Valera is sold on the Unimade pump.

"Among all the technologies available here in the Philippines, it is the IDRC [Unimade] pump that is adapted to the level of the people in the village," she says. "It can be installed, it can be maintained, and it can be repaired by women."

Ms Valera would like to see future water projects focus on women and children. She says women are the "change agents responsible for transferring the proper attitudes about use of water to children."

This article was compiled from submissions by: Mark Timm, a Canadian freelance writer in Southeast Asia; Edison Dy Ong, a Manila-based freelancer who writes about science and development; and Gerry Toomey, Reports Associate Editor, reporting from Kuala Lumpur and Manila.

WOMEN IN CONTROL

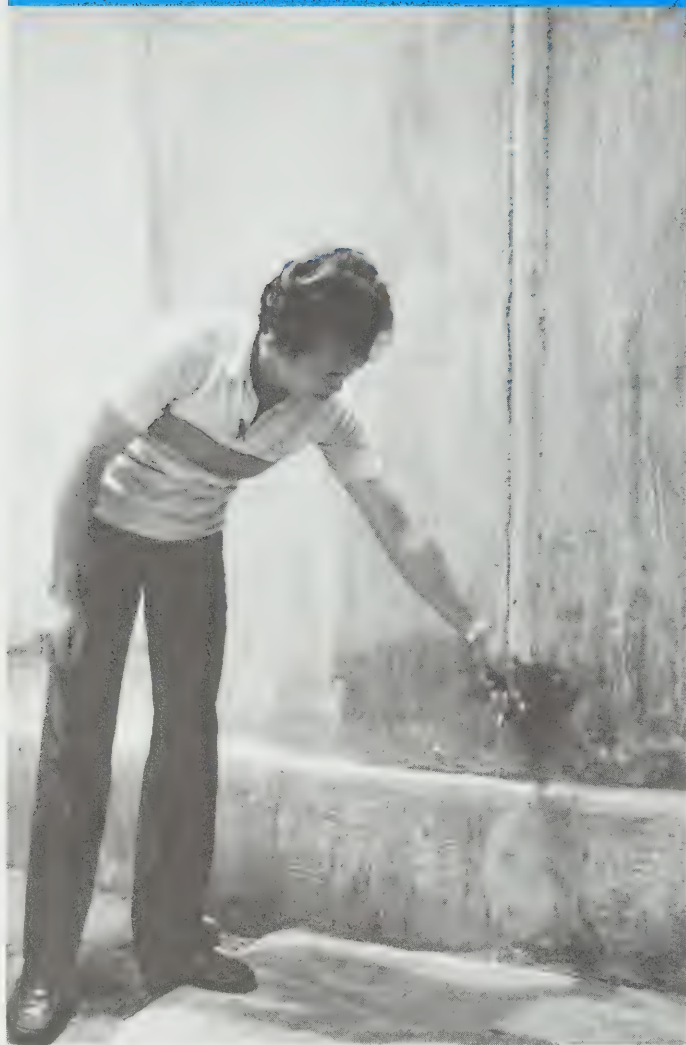
Under the IDRC-supported handpump project in the Philippines, village organizations were involved from the very start. They decided on the best location for the pumps, learned to maintain and repair them, and chose trusted community members to serve as project monitors. More often than not, the planners, implementors, monitors, and beneficiaries of the pump installations were women.

"Since the women actually do the cooking and washing, they were made responsible for looking after the pump, its proper usage, and regular cleaning," explains Mediatix "Peanuts" Valera, leader of the project.

In one case, the women, realizing the value of safe water, "contacted the Department of Health to visit their pump and chlorinate the water. Later, following the instructions, they did regular chlorination on their own."

Participants' behaviour, however, was not always driven by scientific reasoning. In one instance, recalls Ms Valera, the drillers were forced to transfer to another site when a project participant expressed a "superstitious belief that the drilled hole in that area would never yield potable water."

The reason for her belief? A blackbird had flown across the sky while the well was being drilled.



BANKING THE RAIN

Ferrocement technology, in which mortar is spread over a steel and wire skeleton, is a simple and inexpensive way to build strong rainwater cisterns. In one dry area of the Philippines where drinking water is scarce and a low water table often makes the use of handpumps impractical, such ferrocement containers are helping villagers to put rainwater to good use.

GERRY TOOMEY

It will serve many purposes — for the toilet, the kitchen, and our little pig-gery,” says Arturo Diestro. He is referring to the new 6000-litre cylindrical rainwater catchment tank that he and his family have built in their yard with the help of a provincial government construction team. It is one of 10 such cisterns in the village.

The wall of the cistern is only a few centimetres thick, but because it is reinforced internally with a framework of large-gauge welded steel mesh covered with fine wire mesh, it can support the pressure exerted by the water.

Here in the small community of Agkilo-Conciencia, in the Philippine province of Capiz, Mr Diestro normally uses a large gal-

vanized iron tank for storing rainwater, a luxury most residents of Capiz can't afford. “But it's leaking,” he explains. It has lasted eight years but has needed overhauling every second year because of corrosion. This is expensive, he says, and involves a lot of work — changing the end pieces, repainting, and welding. The new ferrocement tank, on the other hand, is expected to last for 25 to 50 years with minimal maintenance and is therefore a welcome change.

Around the world, human ingenuity has given rise to many practical technologies for supplying clean drinking water — the most basic need of Mr Diestro, his family, and every other human being. During the bonechilling winter of the Canadian Arctic, for example, some Inuit hunters hack tonnes of ice from

giant freshwater icebergs that have become stuck in coastal sea ice. Then they haul it home on snowmobiles and later melt it.

In Southern Africa, in Botswana's Kalahari Desert, Basarwa hunter-gatherers use long straws to suck water from small underground “siphones” that have trapped precious rainwater. And in Guatemala, some communities tap mountain streams by connecting long networks of pipes to village faucets.

As for ferrocement, its systematic development as a technology — for applications as varied as roofing, grain storage, and boat building — dates back only about two decades. The concept itself, however, is at least 150 years old.

The technology is simple in theory. But translating it into a technically sound, socially acceptable, and affordable village technology requires detailed research and field testing. In Capiz, on the Philippine island of Panay, the IDRC-supported project which provided Mr Diestro and other villages with household rainwater tanks is carrying out such research. To date, the work has been very promising.

The Non-Formal Education Program run by the Office of the Governor of Capiz serves as the focus of the project. Heads of selected households are sent for a week's training in ferrocement techniques and then are provided with the materials needed to build their own tank. An 11-member team of engineers and technicians, headed by civil engineer Constancia Fagtanan of the Provincial Planning and Development Office, is responsible for supervising construction of the ferrocement cisterns, locally known as “C-tanks”.

Four sizes of tank are being built in Capiz: 4000, 6000, 10 000, and 16 000 litres. The larger models are used for schools and other institutional applications, the smaller ones for households. The cost of materials (but not labour) ranges from about 3000 pesos (CA\$270) for the smallest model to 12 000 pesos for the largest (CA\$1080). In the case of household tanks, owners must sign a contract to repay the cost over several years. The money goes into a revolving fund for the purchase of materials to build more tanks.

In Capiz, as in other parts of the Philippines, few people have access to piped water. Traditional sources are springs, rivers, and wells. Unfortunately the quantity and quality of drinking water from these sources is unreliable, especially during the frequent dry spells. Many sources of underground water have high bacteria and amoeba counts, and the province's incidence of water-borne diseases among children is high.

There is nothing new about rainwater catchment in the “barangays” (small clusters of households) of Capiz, though most people get their water from the other sources just mentioned. The province's rainfall, though low, is fairly evenly distributed throughout the year and many households are equipped with galvanized iron tanks for collecting rainwater from rooftops. Clay jars, kerosene cans, plastic containers, and old oil drums painted on the inside are also used. In cases where the oil drums haven't been properly treated, however, people run the risk of being poisoned.

An initial 34 ferrocement tanks were built in Capiz with funding from UNICEF after a

devastating typhoon in November 1984 which claimed hundreds of lives and left tens of thousands of families homeless.

The IDRC project, approved the following June, provided funds for research, testing, and the construction of 30 more tanks. Now, the Tubigan Foundation of the Philippines, a national water supply development organization, is providing funding for the construction of 50 more tanks to be connected to public faucets and plans are under way for the construction of another 100 tanks with UNICEF assistance.

The Governor of Capiz, Cornelio J. Villareal, Jr. is the driving force behind this metamorphosis of the province's water supply. He sees the C-tank concept — C stands both for Capiz and Christ, he explains — as one which can be replicated throughout the Philippines.

"With authority, experience, and expertise, we can recommend ferrocement technology as a means to achieve the goal of providing people with potable water." The conviction evident in the Governor's voice is matched only by that of the Christian beliefs he espouses. In step with his conversion to Christianity some years ago, he has worked diligently to make community participation and self-reliance realities in this province of half a million people.

The water tanks are just one element in an integrated provincial development plan organized and directed by the Capiz Development Foundation Inc., of which Gov. Villareal is vice-chairman. The strategy is to build self-reliance through small-scale projects in which villagers

learn by doing. Activities include a low-cost housing project aimed at the poor, especially victims of the 1984 typhoon, as well as training in ceramics, carpentry, farming, and other money-making ventures.

During a visit with several villagers who successfully built a 16 000-litre tank for a local school, Gov. Villareal throws out a challenge: "Why not build little tanks and try selling them?" With another family that has built a tank with provincial funding, he suggests raising chickens or hogs as a way to pay off the outstanding debt.

The message is always the same: people must take charge of their own progress; the government and development organizations are there as catalysts. The projects with the most chance of working are those that can be carried out by small community groups and then be replicated elsewhere.

As for water supply, Gov. Villareal estimates that Capiz would need some 50 000 tanks to cover the needs of the 80 percent of the province's population without proper access to potable water. "Give me the money and we'll build them!" he says.

While the training of villagers and construction of tanks proceeds, the Governor and his C-tank team are now discussing plans with IDRC and other donors to set up a ferrocement training centre in Capiz. This would enable the lessons learned and expertise gained in Capiz to be passed on to nongovernmental organizations from the other provinces of the Philippines and perhaps from other countries. ■



Rain trough and stone-and-gravel filter system atop a large tank at a school.

BUILDING A FERROCEMENT TANK

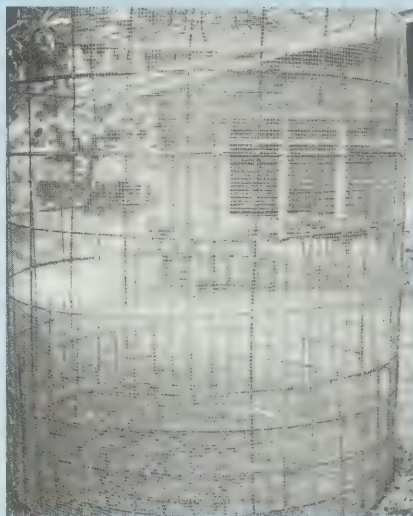
The construction of a ferrocement rainwater tank consists of four major steps: preparing the foundation, constructing the mesh "cage" or skeleton, plastering the cage with mortar, and curing.

Construction of foundation. The site should be solid ground and preferably elevated so that the water can flow to the recipient's household by gravity. The circular site, a little larger in diameter than the tank to be installed, is scraped flat and should have a very slight slope (this allows complete drainage when it's time to clean the tank). A layer of concrete 3 to 5 centimetres thick is poured over the site. Once dry, the concrete pad is covered with a polythene sheet or waterproof cement bags.

Assembly of cage. The cylindrical cage, with floor and ceiling, is made of two layers of large-gauge welded steel mesh, each covered by fine wire mesh held in place by short lengths of wire. The floor is assembled first, then the cylindrical wall (along with overflow pipe, drain pipe, faucet pipe), then the roof (containing an 80-cm-wide entrance to the tank). When the cage floor is complete, it is moved to the tank site and placed over the concrete foundation. The polythene sheet is left in place, between the floor and foundation. The cage floor is then plastered with mortar and covered with wet burlap bags for curing. The polythene sheet

prevents the mortar from sticking to the concrete slab so that the tank can be later moved to another site if so desired.

The completed cylindrical wall of the cage can then be placed over the finished floor and fastened to it. In turn, the roof of the cage can be built and fastened to the wall.



Plastering. Once the pipe fittings are securely in place, the cage is plastered with mortar made of 10 parts cement, 15 parts sand, and 4 parts water. Beginning at the bottom, the plasterers work their way up the cage in tiers, using their hands or trowels. The workers complete both the outside and inside of a tier before moving up to the next tier.

Curing. A month is needed for complete curing although the tank will have attained most of its strength within two weeks. For the first 24 hours after plastering, the surface of the tank should not be permitted to dry out.

Once cured, the tank can be filled with water and checked for leaks and cracks. If any are discovered, they can be easily repaired before the tank is put into service. The tank should be dried out for three or four days before the inside is given two coats of nontoxic paint.

At this point the tank can be connected up to the roof rain gutter and household pipes, ready for many years of service.



IMPROVED COOKSTOVE PROGRAMS: BOON OR BOONDOGGLE?

Over the past three decades, many well intentioned programs to promote improved cookstove designs petered out. But lessons were learned. Now, a better understanding of both the technical and human aspects of stoves is once again firing up enthusiasm for this important technology.

HARTMUT KRUGMANN

In home after home in the Mexican village of Cheranastico, 300 kilometres northeast of Mexico City, women shyly show off the new cookstoves in their kitchens — stoves they have built themselves.

The large sand-and-clay stoves replace the smokey and often inefficient three-stone fireplaces that these women and their ancestors have traditionally used for cooking.

The new stoves have three openings on

which to sit cooking pots so that three things can be cooked at a time instead of one. The women explain that the stoves require less fuel, so they spend less time gathering wood. They also point out that the stove's chimney, made of used oil cans stacked on top of each other, takes the smoke right out of the kitchen. Having these improved cookstoves, say the women, is a status symbol.

Introducing improved cookstoves to this community of less than 100 families is part of

an IDRC-supported project carried out by the Universidad Nacional de Mexico. The project team established a workshop in the village and taught a group of women to fabricate the stoves. In turn, those women themselves became teachers.

But bringing improved cookstove technology to rural people is not as simple as this description may suggest. Some of the stoves were poorly built because the women didn't mix the sand and clay properly. And the stoves were not gifts — the families had to acquire the materials themselves and the long construction process cost the women valuable time away from their daily tasks.

Although the researchers on the project say the stoves have improved the lives of the people in this isolated village, the costs involved may inhibit dissemination of the technology on a wider scale.

Lack of widespread use

According to the UN Food and Agriculture Organization, about 100 stove projects and programs had been initiated by 1983. Virtually all international development donor agencies have been involved in one or more of them. However, after years of promotion it became clear that widespread diffusion wasn't occurring.

Why did the early cookstove programs, most of them launched in the 1970s, do so poorly? As one World Bank official put it: "The first generation of stoves and stove programs failed to deliver because they did the wrong thing, in the wrong way, for the wrong reasons and with the wrong people."

The promotion of improved biomass-burning cookstoves in developing countries dates back to the late 1940s. Among the better known models in the first wave of improved cookstoves were the HERL stove in India in the 1950s and the Singer stove in Indonesia a decade later. They were equipped with chimneys because the emphasis at that time was on reducing or eliminating smoke at the fireplace — a health concern that has recently been moved back on to the front burner.

In the middle and late 1970s, the notions of 'small is beautiful' and 'appropriate technology', along with growing environmental concerns, ushered in a second wave of cookstove programs, this time the prime design objective being fuelwood conservation.

The switch of focus was based on three observations. First, developing countries were dependent on wood for most energy-consuming tasks, especially cooking. Secondly, deforestation was becoming a serious problem. And thirdly, traditional cooking systems were not very energy efficient — figures of 5 to 10 percent efficiency were often cited.

The assumption about gross inefficiency is not necessarily correct. Laboratory tests show three-stone fires to be up to 20 percent efficient and sometimes even more economical with regard to fuel consumption than the "improved stoves".

The efficiency of such traditional cooking

Far left, an improved clay cookstove in Bamako, Mali. Right, an institutional stove that can accommodate large pots. Far right, breakfast is prepared on a metal stove in the village of Gladié in southern Mali.



systems depends as much on the habits of the user as on the shape and structure of the stove.

Fuel consumption with traditional stoves can be reduced by careful fuel feeding and fire tending, sheltering the fire against draught, and the use of a grate. Indeed, substantial fuel savings are found in situations where people recognize that fuel is scarce.

Traditional stoves and fireplaces also have some added bonuses: they are highly versatile, provide light and heat, and are easy and inexpensive to build. It is not surprising, therefore, that it is quite difficult to compete against these devices.

Users' needs ignored

In many of the early cookstove programs, little or no effort was made to examine the needs and preferences of stove users. Without their feedback, designers failed to transfer certain valued functions of traditional stoves to the new models.

The assumption that fuel economy is a top priority for stove users is no longer considered valid — especially as regards rural users. Many of the earlier cookstove programs also failed to define their target groups. For instance, dissemination programs and training courses often focused on men even though women are the principal users.

Early cookstoves were often designed by people with a great deal of enthusiasm but little technical background. It is now recognized that proper design requires an understanding of thermodynamics and engineering principles, a methodologically sound research program, information on the needs and skills of the intended users, and a sensitivity to manufacturing and dissemination factors.

Many early cookstove programs introduced bulky, heavy models, often made of sand and clay, with one or more pot openings and a chimney. These stoves generally use a lot of fuel because they absorb large amounts of heat while warming up. They can also deteriorate rather quickly.

The presence of a chimney can cause difficulties with air flow and heat transfer to the pot. The fact that these stoves are built on-site, often by their owners (as in the village of Cheranastico), complicates quality control, although it may reduce costs.

Early cookstove designs were proclaimed fuel-efficient but few lab tests and almost no field tests were carried out to substantiate these claims. The little testing that was done tended to be inadequate or faulty, and did not look at fuel performance over time. In some cases, lab test results were simply assumed to hold true in real-life situations.

In the past few years, better criteria and more rigorous testing procedures have been introduced. Principles of stove design and critical dimensions, such as the distance between the pot and the grate, have been identified. These advances have led to a shift away from bulky mud stoves constructed on site, toward light, portable metal or ceramic stoves that are more durable and transfer heat better, and whose

manufacture allows for easier quality control.

The early stove programs were also hampered by economic factors. Stoves were often too costly for the target population and had to be subsidized to ensure acceptance.

Initial subsidies may be justified but a stove program must eventually stand on its own. Extended subsidies can stifle the development of competitive local manufacturing enterprises and may also make stove recipients careless about maintenance because their personal stake is small.

Shift to urban users

Stove programs started out focusing on the rural poor. Now it is recognized that rural people are a much more elusive target than originally thought. For one thing, fuelwood economy isn't always a priority for them since they usually collect their wood free of charge.

Nowadays the prime target of cookstove programs is the urban poor — that exploding sector of the Third World's population who must pay dearly for fuelwood. It goes without saying, though, that rural people in deforested regions such as the Sahel will also continue to be an important focus of such work.

In urban areas, hospital and school kitchens, as well as commercial enterprises such as bakeries, breweries, and restaurants, consume more fuelwood than individual households. Up to 15 percent of national wood consumption is attributed to these institutional stoves. There are, therefore, important opportunities for fuel savings through design improvements. And because the wood is normally purchased, not gathered for free, new designs could also translate into major cost savings. (IDRC is currently supporting, in Kenya, one of the rare research projects on institutional stoves.)

The view that the burning of wood for cooking is an important cause of deforestation is no longer widely accepted. Recent evidence suggests that agriculture and commercial timber exploitation are normally the main culprits.

Fuelwood in rural areas can be obtained from deadwood or cut from trees without killing them. However, in deforested areas where biomass production is minimal, fuelwood consumption can exacerbate environmental degradation. Similarly, urban charcoal markets can result in serious deforestation on the land immediately around cities.

Recent successes

The experience of the last decade has led to improved programs based on new rationale and objectives. Today the importance of socioeconomic and cultural conditions such as people's eating and cooking habits is better appreciated by those working on cookstove programs. User acceptance and quality control

in construction are recognized as prerequisites for success.

A number of programs around the world, with varying production and dissemination strategies, have met with success. A few examples:

In Kenya, charcoal stoves called jikos are built and sold through the market channels already in place for artisanal products. The ceramic liners that have been added for better insulation are produced in factories; the stove bodies are built by traditional jiko artisans. The number of units built and distributed annually is around 100 000 and rising.

In Karnataka State, India, an innovative sand-clay stove with a grate, chimney, and three pot openings has been very successful. Average fuel savings of 52 percent and a unit cost of about CA\$9 are claimed.

In Guatemala, a national committee under the energy ministry's leadership has been formed to coordinate various efforts to introduce Lorena stoves.

In West Africa, a regional stove program's initial efforts in Burkina Faso, Mali, and Niger are promising. High-quality sheet-metal stoves are being built and sold by artisans for as little as CA\$4 and field tests indicate that they use only 65 to 70 percent of the fuel burned by the traditional metal stoves in use.

And perhaps most impressive is the situation in China where tens of millions of improved stoves are reported to have been disseminated in the last few years.

In the 1950s and 1960s, concern over the health hazards posed by indoor cookstoves was the driving force behind efforts to redesign. In the last few years, that interest has been renewed. The reason lies in the small but growing body of evidence that levels of dangerous pollutants such as carbon monoxide can actually be higher inside village homes equipped with cookstoves than in the outdoor air of polluted industrial cities.

The World Health Organization now ranks respiratory diseases as the major cause of death in developing countries. In view of that blunt fact, the possible link between cookstoves and ill health is a worthy subject of investigation. Indeed, a growing number of field studies of cookstove smoke emissions have been recently undertaken, among them an IDRC project in India. These will help to establish the firm empirical base needed by medical researchers to pinpoint the consequences of indoor smoke exposure. Such findings, in turn, could spawn a new wave of cookstove designs. ■

Dr Hartmut Krugmann is a program officer (Energy Policy) in IDRC's Social Sciences Division. He recently completed a global review of cookstove programs.

DOMINATION BY "COOPERATION"

A Third World perspective on technology transfer and information

"Technology is like genetic material — it is encoded with the characteristics of the society which developed it, and it tries to reproduce that society." Bruno Wambi is chief librarian of the Central library of Marien Ngouabi University in Brazzaville, Congo, and president of the Congolese Association for the Development of Library and Archival Documents (ACDBA). In this commentary, he argues that Third World cultures are the victims of Western technology transfer, all in the name of development.

BRUNO WAMBI

No matter where you are, libraries are tools for social, cultural, and economic progress — integral elements of a country's national development plan. And to do library science is to engage in research and technology. For these reasons, cooperative links between the libraries of the North and those of the South have been established within the framework of development assistance programs.

In practice, unfortunately, the general feeling of euphoria died after the first two development decades. The reason is that the problems of the general masses have not been solved in all the countries of the South. A persistent disenchantment has replaced the illusions that marked the beginning of cooperation. Worse, the gulf between the have and have-not countries has widened, with the wealth of the developed countries having fed itself off the poverty of the underdeveloped countries. As a result, when it comes to imported development models, the Southern countries are hostile toward the donor countries and mistrust them. This disillusionment has driven Third World nations to be more inward-looking, more self-preoccupied, according to Jacques Bang in his book *Quelle voie de développement pour l'Afrique?* (Which development path for Africa?).

Ninety percent of the people in our countries are forced to live in silence because they do not speak the language of technology and progress. Their silence is political, technical, and ideological. The remaining 10 percent of people believe this is the logical state of affairs. What then is the basic condition for development?

I will not rehash the theories which practice has relegated to the garbage can of history — theories such as the universality of science, the neutrality of science, and the premise that science is truth. Science, of course, is neither universal, neutral, nor synonymous with absolute truth. These labels were pinned on science so that it could be used in that great expansionist plan whereby the title "human being" is denied to the other human beings of the planet.

To tell the Third World that science is neutral is the same as telling them that all questions have already been asked, once and for all. It is to tell them that to solve their problems, all they and future generations have to do is dip into the grab-bag of scientific solutions invented in and for the countries of the North.

The question arises whether all societies must pass through this process of so-called development? In other words, is it really desirable for the whole world to become an industrial civilization? Why shouldn't we have the right or, dare I say, the duty to follow our own path and even to distinguish science from progress, development from Westernization — concepts that have been intentionally conflated. Are we really unable to escape the perpetual human urge to dominate through the power of the intellect?

To build a coherent, development-oriented economy, we must rely on the work of ethnologists who are able to describe both industrial and traditional societies. Western logic, based on objective knowledge and essentially materialist, is in direct opposition to the mythical way of

thinking found in nonindustrial societies.

There is an enormous psychological cost to modernization. Advanced technologies, imported without question into the new nations of the Third World, can do more bad than good. Why?

To begin with, Western technology has been designed in light of the many resources available in the rich countries: financial capital, workers with specialized skills, raw materials, energy, and so on. As such it is not directly transferable to poor countries where money and energy are scarce and human resources are abundant. The social, economic, and cultural interests of Third World countries are often directly opposed to those of the rich nations.

Secondly, when an ultramodern factory is sold "ready for operation" to an underdeveloped country, chances are it will be built in an urban area and create jobs there, rather than in the rural areas where the need is greatest and the weight of poverty most onerous.

Finally, large foreign industries recruit their managers and technical staff from among the 5 to 10 percent of the population that makes up the local elite. And it is these same people who end up reaping the benefits of their activities. Thus the vast majority of the population is ignored and will never benefit from the presence of a new high-tech industry in their area.

It is clear that the industrialization model adopted by most developing countries has only accentuated the gap between rich and poor. It almost always reinforces the societal schism whereby 5 to 10 percent of the people form the elite — industrialists, businessmen, large land-

owners, politicians, bureaucrats, doctors, engineers, technicians and so on — and far behind trails the other 90 to 95 percent of the population, the poor peasants, half of whom live below the poverty line.

Technology is like genetic material — it is encoded with the characteristics of the society which developed it, and it tries to reproduce that society if the economic, social, and political environment is compatible with it and malleable. In short, elitist, capitalist societies that export high technology will reproduce elitist, capitalist structures in the importing countries.

To understand this phenomenon, one simply has to look at the mechanisms of technology transfer: provision of massive amounts of capital or financial aid by the exporting countries; knowledge transfer through technical experts; and training of student apprentices from the underdeveloped countries in institutions in the industrialized countries. Even if the injection of foreign capital doesn't directly modify the social structures of the importing country, it nevertheless comes with political strings attached.

The presence of experts from the industrialized countries goes a long way to transferring Western values to the host Third World countries. Scientifically and technically superior, the expatriate experts set up laboratories, work sites, and research centres very similar to the ones they left behind at home. And because in the eyes of their Third World counterparts these expatriates are founts of knowledge, they become models to be emulated. Their lifestyle and way of thinking are copied, clearly to

the detriment of the host country's sociocultural values. The transfer of a foreign technology, then, automatically promotes the transfer of the foreign culture that invented the technology.

Finally, the training of Third World technicians and engineers in industrialized countries also promotes the introduction of Western structures. It is difficult for students to avoid being influenced by the lifestyle of the country in which they are studying. When they return home, they become, of necessity, part of the elite, that select group which follows the lifestyle most likely to perpetuate its position of privilege.

No matter how well intentioned the promoters of technical assistance may be, it is unthinkable that the Third World could pull together the necessary financial, human, and material resources that the technological enterprise demands. For the industrialized countries, it took centuries to build up such resources. Humanity's largest and most shameful programs of dehumanization have always carried noble labels — such as “the duty to civilize”, “development aid”, “technical assistance”, “new world humanitarian order”.

If the Third World finds itself unable to dispense with a borrowed identity, it will have no choice but to reject progress. Its happiness depends on its decision. It must decide on its own culture, joys, dreams, hopes, identity — its own future.

Having said that, we must recognize our duty to show that science is no more universal than the multitude of techniques and technologies that make it up. We must then choose those technologies which

help humanity to reconcile itself with nature rather than dominate it, and which help us to avoid the wasteful habits that consumer societies have forced on us.

We in the South have the potential to build an alternative to this carnivore called science which devours nature and feeds on people and life. We have the potential to create new ways of thinking and acting, ways which are wise and human. In our hands and heads, we hold humanity's best chances of survival.

Because of this I would like to shout out to the researchers, technicians, and engineers of the Third World: “My friends, it's your turn. Design your machines to suit us in the tropics!” I would also like to address my Northern colleagues working in the area of scientific and technical information — the librarians, archivists, documentalists, and consultants who are the main channel of development aid in the area of documentation. I would tell them that we in the South are convinced that it is no longer possible for us to develop according to the models of either the Western or Eastern countries.

Our past experience no longer allows us to confuse cooperation with subordination, bilateral exchanges with unequal exchanges. Our public libraries could henceforth have meaningful roles to play if we can just rid them of the imported frameworks under which they operate and have them become more responsive to the local populations' needs. They need to use the resources available to them to create adapted structures and tools.

New librarians should be trained to meet the needs of the young countries of the Third World. They should be able to compile pools of information pertinent to the interests of the citizenry. They should be able to teach reading and writing and prepare basic spelling books. They should be able to develop audiovisual materials on oral traditions. They should be able to write for children and adults and hold readings in libraries and public halls.

As for our school libraries, they would like to play the same role as their counterparts in Europe and North America. I refer here to

What is essential, though, is that we ensure that the new technologies are adapted to the needs and means of our countries, enabling development to happen from within. We must ensure that the transfer of technologies to the Third World is not tied to the creation of export markets for multinational companies.

There is nothing more disheartening than to see cemeteries of broken-down machines awaiting spare parts or repair by technicians from abroad. And when equipment breaks down every week because it isn't suited to the Third World environment, how distressing it is to have to call in experts from the

“It is no longer possible for us to develop according to the models of either the Western or Eastern countries.”

university libraries, research libraries, and specialized scientific and technical libraries. Our academics and senior technical personnel need the same information as their counterparts in the industrialized countries. After all, science and technology now transcend all geographical boundaries. For this reason, new technologies are of great interest to us. We do not want to continue using outdated information; we want to tap the latest sources of information so that our researchers are in tune with the rest of the world.

company you've been forced to sign a service agreement with.

So, dear colleagues and partners of the North, if you truly wish to help us, give us the means to self-development. Always remember to take into account our particular circumstances and needs, and please do not impose your solutions on us. This is the price of harmonious cooperation between the libraries of the industrialized countries and those of the Third World. ■

LDCs exempt from 'Law of the air' for 10 years

Twenty-four countries plus the European Economic Community signed the first ever "law of the air" treaty in Montreal, Canada, last September 16.

The treaty commits the signatories to slowing the rate of atmospheric ozone depletion by reducing their consumption of chlorofluorocarbons (CFCs). Third World signatories, however, are exempt from the new limits for 10 years.

The treaty calls for CFC cuts amounting to 50 percent of current global consumption levels, by 1999. The world now uses about 800 000 tonnes of the chemicals annually. Developing countries account for only 10 percent of total consumption.

CFCs are used in refrigerators, aerosol sprays, foam products, and the microchip industry. They degrade ozone, a bluish gas that shields the earth from harmful ultraviolet radiation. Scientists predict significant increases in skin cancer deaths, cataracts, and crop damage from ozone losses.

CFCs also contribute to the "greenhouse effect", a global warming trend caused in part by airborne chemicals that trap heat radiation. This trend could trigger widespread desertification and coastal flooding in the next century.

Jon Allen, legal expert with the Canadian delegation, said the 10-year exemption clause will help poorer nations obtain some benefits from chlorofluorocarbons — such as home refrigerators — before the chemicals are phased out. He said safe and inexpensive alternatives should be available when the exemption period ends.

The exemption clause helped ensure the developing world's presence at the three-day diplomatic conference. More than half of the 63 participating nations were developing countries. Participating countries which did not sign the treaty in Montreal have one year to do so.

Dr Mostafa K. Tolba, executive director of the United Nations Environment Programme, called the conference "a landmark in the history of the environment movement, in international cooperation, and in preventive rule-making". He warned, however, that stiffer regulatory measures may still be necessary because ozone depletion has already begun.

John Eberlee
Montreal

Microlibrary in a carrying case

Obtaining technical information in developing countries can often be frustrating, sometimes impossible. Books are expensive, and there are few good libraries and effective communications systems.

Ordering a book and then waiting six months for delivery can delay a development project or result in technical decisions being based on inadequate information.

The Appropriate Technology Project of Volunteers in Asia, at Stanford University in California, has compiled a microfiche library to help alleviate these problems. It holds over 1000 clearly indexed books and documents reviewed in the Appropriate Technology Sourcebook published by Volunteers in Asia.

The library contains data on many small-scale village technologies including details on how to plan, design, evaluate, build, and maintain, for example, hot air grain dryers, cookstoves, and pit latrines. The library is periodically updated with over 200 new titles added in 1986, including recent publications from IDRC, the Intermediate Technology Development Group, and Volunteers in Technical Assistance.

Volunteers in Asia will soon supply updating kits to Appropriate Technology Microfiche Library owners. The entire library, housed in a sturdy lunch box-sized carrying case, makes it suitable for field workers. It costs US\$695 (about US\$0.70 per book).

Volunteers in Asia is also offering the Cube II, a lightweight, portable microfiche reader (30 x 30 x 25 centimetres, 4 kilograms). It produces full-sized or magnified images and is available in either 110-volt or 220-240-volt models. A 12-volt adaptor enables it to be run off an automobile battery. The Cube II retails at US\$435, but for purchasers of the library it is US\$350.

For further information contact: Appropriate Technology Project
Volunteers in Asia Inc.
P.O. Box 4543
Stanford, CA 94305
U.S.A.

New process uses bacteria to convert sugar to ethanol

A new Australian-developed process for converting sugar into ethanol could provide a boost to sugar

growers who have seen a substantial decline in demand for cane sugar in recent years.

Excess stock and falling demand have caused serious debt problems among cane-producing countries forcing them into a frantic search for alternative uses of sugar. The Sucrotech process, developed by Dr Horst Doelle, may be of special significance to developing countries because they produce two-thirds of the world's sugar crop.

Ethanol, a petrol alternative, is gaining popularity in some Third World countries. Over 70 percent of automobiles now sold in Brazil are fueled entirely by ethanol. Argentina, the Philippines, and other South and Central American countries are also following Brazil's lead.

The Sucrotech process ferments sugar by using a *zymomonas mobilis* bacterium strain instead of traditional yeast. According to a spokesman for Queensland Science and Technology Limited which runs a pilot plant using the new process, the conversion efficiency of the Sucrotech process is five percent higher than the yeast method.

Unlike yeast, the bacteria can produce fructose and ethanol simultaneously. The flexibility of the process makes it possible to vary the proportion of ethanol or fructose produced in response to product demand.

Switching to this new process simply requires replacing the yeast now in use with the *zymomonas mobilis* bacteria.

The Virgin Islands has adopted the process in two of its sugar plants, while Brazil, Trinidad, and Jamaica are negotiating for its use.

Emilia Tagaza
Gemini News Service

Mozambican latrine makes for better sanitation

Despite the agony of drought, famine, and rebel attacks, Mozambique is quietly trying to improve the living conditions of its rural and peri-urban populations by constructing inexpensive pit latrines to promote community health.

Since 1979, IDRC and the United Nations Development Program (UNDP) have supported the development of technically sound and hygienic latrines.

The heart of the latrine is a platform or slab of unreinforced concrete, rising gently in the centre to form a low-lying cone. To date, under

the supervision of Mozambique's National Directorate of Housing, more than 25 000 slabs, manufactured by 12 community latrine construction cooperatives, have been sold and installed, benefitting over 125 000 people.

The conical slab features a smaller opening to encourage use by all family members including children, a close-fitting lid for odour and insect control, and footrests.

In 1970 Mozambique had only 60 000 latrines. Diseases linked to poor sanitation were rampant and infant mortality was extremely high. In 1976, an aggressive latrine-building campaign, launched by health care workers, resulted in a 20-fold increase in latrines. By 1984, 72 percent of the urban households owned latrines.

However, the anticipated health benefits didn't materialize, largely due to poor latrine design, improper use, and lack of maintenance. Latrines with poorly fitting covers gave rise to odour and health problems. Wooden platforms used in latrine construction were difficult to keep clean and liable to rot and collapse. The conical slab developed with IDRC and UNDP help solves a number of such problems.

To ensure that slabs are sound, each must be able to bear the weight of six men without cracking. It must also bear the signature of the maker so that those who produce defective slabs can be identified and shown how to correct the problem. Slabs cost US\$10 each and carry a lifetime guarantee.

IDRC and UNDP also helped train about 350 people at the Maxaquene pilot workshop near the capital, Maputo. They are now deployed as professional latrine constructors and community motivators in co-ops and city councils.

Photo: UNDP



The latrine slab should support the weight of six men.

In addition to IDRC and UNDP, support to Mozambique's national sanitation program is provided by UNICEF, the World Health Organization (WHO), the Government of the Netherlands, CUSO (a Canadian nongovernmental organization), and SAH (a Swiss nongovernmental organization).

Hilda Paqui
United Nations Development
Programme

New service for evaluating pesticide impact

Britain's official foreign aid agency is offering a new consultative and information service on the environmental impact of pesticides. It is aimed at scientists and development project personnel working in the Third World.

The Pesticide Impact Section is part of the newly organized Overseas Development Natural Resources Institute (ODNRI), which in turn is the scientific arm of the UK's Overseas Development Administration.

The stated aim of the new section is to promote the judicious use of pesticides and ensure minimal environmental damage. According to ODNRI, the section can provide information and advice on the environmental impact of development projects in which pesticides are used, and can help scientists choose the most appropriate pesticide for local conditions. Experts are available to design and carry out impact studies.

Of particular interest to agricultural specialists, including Third World farmers, is a new bibliographic service called ENVIRON, offered by the Pesticide Impact Section. ENVIRON is a computer data base containing listings of books and scientific articles about the environmental side-effects of pesticides (including herbicides and fungicides) in the tropics. Topics covered by the service include pesticide toxicity to non-targets such as soil, birds, and other organisms, and the persistence of pesticides in the environment.

The bibliographic service is not available on line, but requests can be handled by letter. For more information, write to:

Pesticide Impact Section
Tropical Development and Research
Institute
College House
Wrights Lane
London W8 5SJ
United Kingdom

Worldwatch on urban growth

By the year 2000, every second person on earth will live in a city — a situation that will have far-reaching ecological and economic repercussions.

Mexico City, Calcutta, and many other giant cities require a concentration of food, water, and fuel on a scale not found in nature. Urban populations are using a disproportionate share of fiscal and natural resources and are creating a disproportionate share of the wastes.

This dilemma and how it might be dealt with are the focus of the recent Worldwatch Institute publication, *The Future of Urbanization: Facing the Economic and Ecological Constraints*.

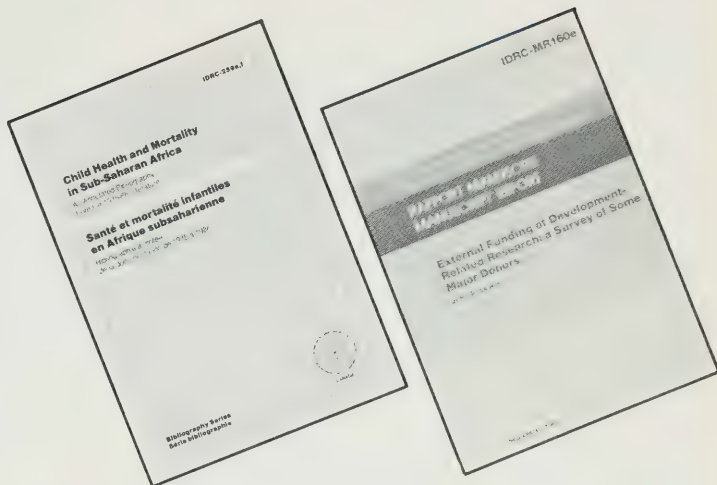
The authors, Lester Brown and Jodi L. Jacobson, write that the abundant resources and economic growth that facilitated urbanization earlier in history can no longer be taken for granted. "Urban areas, larger and more numerous than ever, have outgrown the capacity of natural and social systems to support them. As a result, today's cities may be inhibiting, rather than aiding, efforts to raise living standards in an equitable fashion."

But the authors say there are ways to offset the economic and ecological costs of supporting large cities. Energy problems associated with oil can be reduced through use of alternative, renewable energy sources such as wood, agricultural wastes, hydro electricity, and innovative garbage-fueled electric generators and solar collectors. Water pollution could be reduced if human wastes were shipped to rural areas as fertilizer.

The authors maintain that city population growth would slow down if more social services, including basic health care and education, were offered in rural areas, and if governments removed the urban biases from their economic policies to encourage investment in the countryside.

For more information, write to:
Worldwatch Institute
Paper No. 77
1776 Massachusetts Ave., N.W.
Washington, D.C. 20036
U.S.A.

Cheryl Ferguson
Ottawa



Child Health and Mortality in Sub-Saharan Africa

A bibliography compiled by Fiona Mackenzie, IDRC-259e, 223 pp.

Infant deaths account for 40 percent or more of all deaths in developing countries. Initial reductions in mortality can often be achieved through health technology. It is now recognized, however, that sustained reductions in infant mortality can be achieved more effectively through programs that address the biomedical, socioeconomic, cultural, and environmental determinants of infant mortality. The design and implementation of programs that include socioeconomic development and behavioural change require the collaborative efforts of researchers from various disciplines, including health scientists, nutritionists, social scientists, demographers, and educators.

The production of this bibliography was undertaken by the Population, Health, and Development program of IDRC as a way to encourage interdisciplinary study of infant and child health and mortality.

External Funding of Development-Related Research: a Survey of Some Major Donors

John P. Lewis,
IDRC-MR160e, 68 pp.

Since the early 1960s, international aid agencies have allocated substantial funds to research on the problems of international development. In 1984, aid to such research was between CA\$1.7 and 1.8 billion. This manuscript report from IDRC notes that beginning in 1970 development-related research began to stabilize at around 4 percent of total aid to developing countries. As for IDRC, its contribution is estimated to be 4 percent of total world funding for development-related research.

The survey did not attempt to poll all donors but was limited to official donors and, among these, to the larger ones and/or those that had displayed a particular interest in research funding. Countries surveyed were: Canada, France, Italy, Japan, the Netherlands, Sweden, United Kingdom, United States, and West Germany. Two Arab/OPEC agencies were also surveyed as well as the following multilateral agencies: the Asian Development Bank, the Inter-American Development Bank, the United Nations Development Program, and the World Bank.

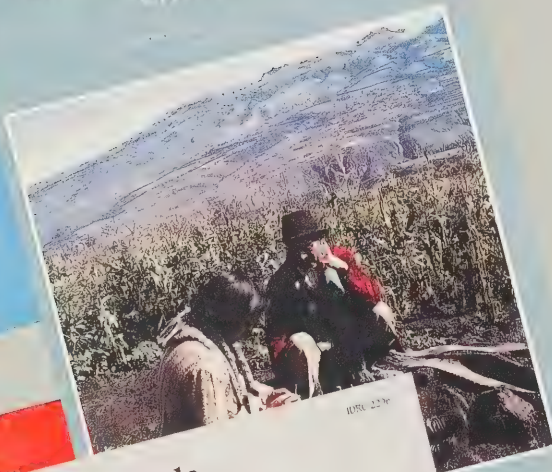
Le sucre Menace ou défi ?

Évaluation de l'incidence du
développement technologique
dans les industries des
produits surochimiques et du sirop
de glucose à haute teneur
en fructose

Clive Y. Thomas



Metodología de Investigación en Sistemas de Cultivo en línea



Small-Scale Fisheries in Asia: Socioeconomic Analysis and Policy



Editor: Theodore Panayotou

In addition to IDRC Reports, the Centre publishes a wide range of material on development issues. These include scientific monographs, reports, and bibliographies on specific IDRC research areas, as well as general interest literature. These publications represent research interests and activities supported by IDRC in agriculture, food and nutrition, population, health, education, information, and social sciences. Films describing the Centre and some of the areas of development research are also available. A catalogue of current material, publications or films, is available from the nearest IDRC regional office or from IDRC in Ottawa (see page 3 for complete addresses).

Publications may be ordered from the IDRC sales agents listed here.

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- The Textbook Centre
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- Tanzania Publishing House
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P.O. Box 2138
Dar-es-Salaam, Tanzania
- Educational Distributors (Private) Ltd.
P.O. Box 3799
Stand 1299 Kelvin Road
Harare, Zimbabwe

Asia

- Select Books Pte. Ltd.
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Arlington, VA 22209
U.S.A.

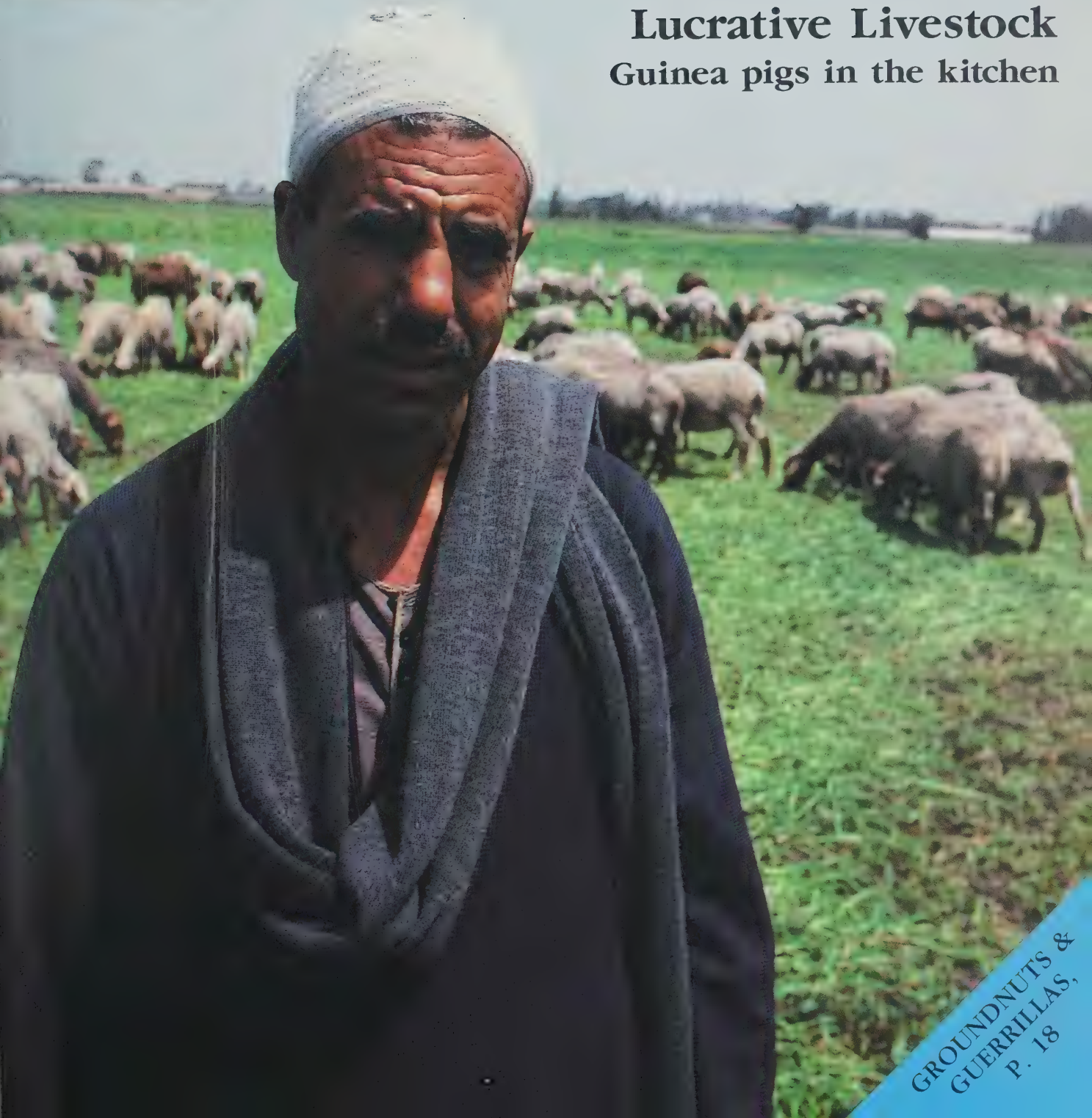
LACKING VOL. 17, No. 2

Reports

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Lucrative Livestock Guinea pigs in the kitchen



GROUNDNUTS &
GUERRILLAS,
P. 18

Letters

Literacy, science and the Koran

I read the article "Morocco's Koranic schools" (*The IDRC Reports*, January 1988) with interest. I have never been to Morocco, but I have been to several Islamic countries. During my visits, I have observed the Koran being taught in different ways, using different methods.

One group I have studied rather closely is the Ahmadi Muslims, who are concentrated in the West African countries, Indonesia, and the Indo-Pakistan subcontinent. Their way of teaching the Koran and modern sciences is rather unique. (They have produced the only Muslim Nobel Laureate in the field of science in the person of Dr Mohammed Abdus Salam.) Ahmadi Muslims, as a community, do not leave the teaching of the Koran to the taleb as they do in Morocco. Rather, it is part and parcel of their secular educational system. Through their philosophy of "each one, teach one", Ahmadis have developed a closely knit organization claiming 100 percent male literacy and 75 percent female literacy (in separate schools).

The example of the Ahmadi Muslim community reminds me of early Muslim Spain which not only excelled in Islamic learning between the 8th and 12th centuries A.D., but also had no equal at that time in its level of scientific achievement. That is why scholars from all over Europe went to study at Cordoba during that time.

People in Muslim Spain not only learned their religion for their personal development (and salvation) but also used it for scientific discovery—the Koran again and again stresses the importance of observation and experimentation. Unfortunately, apathy slowly crept in, things slowed down, and scientific learning started shifting to other countries.

If someone wishes to pursue this subject, I may be of some help with Dr Abdus Salam's numerous papers. *History of Science* by G. Sarton is also a very revealing and perceptive book on the subject. I also have a couple of papers of my own.

Dr Ijaz Qamar
Professional Agrologist
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Winnipeg, Canada
R3C 3R2

Beans in India

With reference to Anne Fisher's article "Rating beans" (October 1987), here is what happens in India.

All beans are sun-dried and stored in environments varying from the cold Himalayas to the near-equatorial tropics. They are used in whole or split (dals) form or as flours. The flours can be made into a batter as well as a dough which is rolled or extruded into friable foods. Sweets made from the flour are exceedingly popular.

To make cooking easier, whole beans, generally soaked overnight at room temperature, are often drained and germinated. The beans and sprouts are eaten together. Quite a few recipes use them raw (soaked or germinated)—a clearly better nutritional food! Many recipes also use cooked beans as a paste or a puree.

Pressure cookers, common in Indian homes, cook unsoaked beans in 10 to 20 minutes. The addition of a pinch of soda-bicarb is popular for a well cooked bean.

Interestingly, slow cooking is a traditional practice in the deep rural areas, not yet exposed to kerosene, liquid propane gas, or biogas stoves. People in these areas burn wood or coal in fireplaces made of clay, which retain heat for a long time. After cooking the main meal, they partially douse the fire and the pot containing the soaked beans is placed on the embers. Beans so cooked are rated tastier than those cooked by other means.

H.S. Gurudas
Executive Director
Protein Foods and Nutrition
Development Association of India
Bombay, India

A hedge against drought

I am a recipient of a 6000-litre rain-water catchment tank in Capiz Province, Philippines, as part of an IDRC project. Last March 24, I was so surprised when the personnel of the Governor of Capiz visited me and shared a copy of the January 1988 issue of *Reports*. On page 20, under the title "Banking the Rain", I saw my picture—I was opening the faucet of the water tank. I was very happy seeing my picture and name published in that international magazine and proud to have a ferrocement water tank.

You know it is dry season in our place now (April 1988). Drought started in December. Our crops, especially rice plants, were destroyed and we harvested only 15 to 20 percent of our crop. This means famine if the rain does not come early.

At the start of the dry season, I economized the use of our rainwater in the ferrocement tank. I didn't use it for anything except drinking, as we don't know when the rain will come. We have to fetch water for our daily use in the kitchen and the piggery from a far place (150 metres away). Up to now I still have a safe stock of water to drink from my tank. I hope it will last up to the rainy season.

Our neighbours here and relatives wanted to have such a tank. I just told them to hope and pray that IDRC will have more projects in Capiz. It's a very useful project.

Arthur D. Diestro
Conciencia, Panitan
Capiz, Philippines

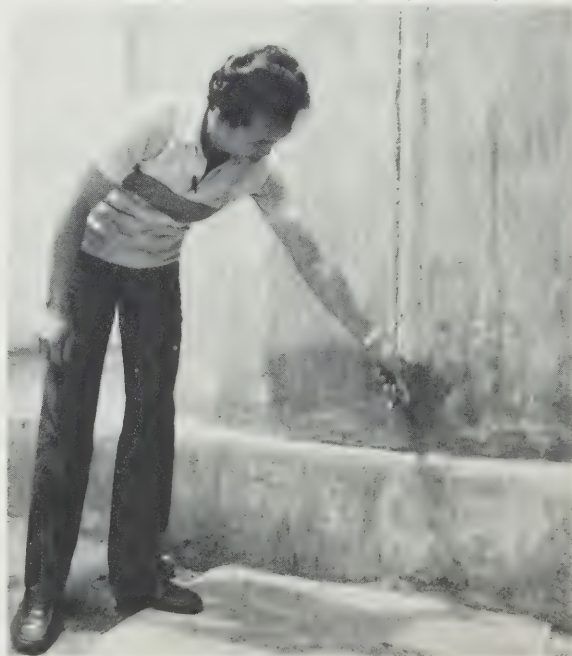
Your feedback is appreciated

Reports welcomes letters of comment and information from readers. If you're engaged in development work similar to the projects described in the magazine, let us know — other readers may be interested. Or, if you wish to take issue with an article or clarify certain points, drop us a line. Letters should not exceed 250 words and are normally edited.

Write to:

The Editors
IDRC Reports
P.O. Box 8500
Ottawa, Canada
K1G 3H9

Photo: Gerry Toomey / IDRC



Diestro with
ferrocement tank.
Potable water is
a precious pos-
session.

Cover photo:
Egyptian shepherd in the
Nile Delta.

Photo: R. Charbonneau / IDRC

Reports

THE IDRC



IDRC

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CONTENTS

Letters

2

OUR THEME THIS ISSUE: LUCRATIVE LIVESTOCK

Fine-tuning the old ways

4

Traditional ways of raising animals need improving. Imported high-input methods rarely suit developing countries. *By Geoffrey Hawtin.*

Fiesta for six: one guinea pig

6

In Peru this little rodent isn't so little and makes a delicious entrée. *By Robert Charbonneau.*

A cow's barn is her castle

9

These days, farmer Janvier of Burundi is taking better care of his cows because it pays. *By Denis Marchand.*

Green feed for Bali cattle

11

A new Indonesian forage system gives farmers a more stable supply of animal feed and uses scarce land more efficiently. *By Robert Inness.*

Friends of the family

13

Raising goats and sheep ensures nutrition and financial security for families, especially women and children. *By C. Devendra.*

Woolly survivors

14

Better management is boosting the birthrate of Peruvian alpacas as well as wool and meat production. *By Robert Charbonneau.*

Botswana's new breed

16

Crossbred cattle combine environmental adaptability with high milk yield in this desert country. *By Robin Cox and Doane Gregory.*

Starting from scratch

18

The war in Mozambique makes work difficult and dangerous for a team of Mozambican peanut researchers. *By Rhoda Metcalfe.*

Sorghum as substitute

20

Small mechanical grain dehullers are at the centre of a major effort to create food enterprises for women in southern India. *By Gerry Toomey.*

Alcoholism: Chile's medical blindspot

22

A study shows doctors need better training in how to recognize alcoholism. *By Robert Charbonneau.*

Learning English step-by-step

24

A language teaching and learning program, now used in 500 institutions in China, emphasizes "authentic" English. *By Gerry Toomey.*

Computer matchmaking

25

The SIFT information network won't find you a spouse, but it will identify Latin American and Caribbean development projects in need of investors. *By Wilson Ruiz.*

In Brief

26

News and trends in international development.

New releases from IDRC

27

FINE-TUNING THE OLD WAYS

GEOFFREY HAWTIN

Long before recorded history, human beings learned to rely on animals for many of life's necessities—food, clothing, shelter, and transport. Originally people relied on animals captured from the wild, but eventually certain species were domesticated as society made the transition from hunting to pastoralism and agriculture.

It is believed that in Asia, Europe, and Africa, buffaloes, sheep, goats, and pigs were domesticated 7000 to 10 000 years ago. Goats and sheep may even predate the full development of crop-based agriculture.

In Latin America, although this process was probably more recent, the camelids (llama and alpaca) and guinea pigs are likewise believed to have served mankind for several millennia.

Worldwide, animals have remained an essential component of agriculture and can be found on almost every small farm in the tropics. In developing countries as a whole, they account for about 25 percent of the total value of all agricultural commodities and provide 20 percent of the protein in peoples' diets. In industrialized countries, by contrast, animals provide 60 percent of dietary protein.

In most societies, animal products are preferred foods and demand for them increases as incomes rise. The UN Food and Agriculture Organization has estimated that demand for meat and milk in developing countries will continue to expand by more than 3 percent a year over the next few decades. This will pose a strong challenge to farmers, policymakers, development workers, agricultural services, and researchers.

This article highlights some of the numerous opportunities for increasing livestock productivity, especially in the traditional farm sector which accounts for the large majority of domesticated animals in developing countries.

Among the many livestock species raised worldwide, ruminants are especially important. They are able to convert poor-quality feeds such as crop residues, agro-industrial by-products, and natural pasture into high-quality human food. Of the estimated global population of 1.27 billion cattle, 130 million buffaloes, 1.12 billion sheep, and 460 million goats, about 66, 99, 52, and 94 percent respectively are raised in developing countries.

Cattle, the world's most important source of meat and milk, are raised in a variety of systems. In the dry areas of Africa and Latin America, for example, ex-

tensive rangeland and pastures are commonly used. Semi-intensive systems, on the other hand, are typical of Southeast Asia and other more humid tropical regions.

Very intensive dairy and beef systems, using efficient breeds under high levels of management, have rarely proved successful in lowland tropical areas of developing countries. The inputs are often too expensive or unavailable, management skills insufficiently developed, and marketing systems inadequate. Nevertheless, much research and development effort continues to be spent on introducing these generally inappropriate technologies. As a result, the upgrading and development of more traditional systems is often neglected.

Buffaloes are also an important source of meat and milk in smallholder systems, especially in South and Southeast Asia. They have received considerably less attention from researchers than have cattle and much remains to be done.

Cattle and buffaloes are a major source of energy on farms. It has been estimated that in the developing countries as a whole, animals are used to cultivate half the arable area, and three-quarters of all animal power is provided by cattle and buffaloes.

Goats and sheep are vital to many pastoral systems and are also commonly found in semi-intensive systems in Asia, Africa, and parts of Latin America. (See p. 13.) They often thrive in areas too dry for cattle or, in the case of Africa, in areas infested by tsetse flies. Due to their small size, short generation interval, and larger number of offspring (compared with cattle), sheep and goats also provide farmers with considerable management flexibility and require only a small capital outlay.

Although resources for sheep and goat research have grown in recent years, in absolute terms they still fall far short of what is needed.

In specific regions of the world, other ruminants are important—the llama and alpaca in the Andes, the yak in the Himalayas, and the camel in the dry zones of Asia and Africa. While their secondary importance does not justify a major allocation of research resources, their contribution to agriculture in harsh environments certainly warrants greater research attention than they receive at present.

Nonruminants such as pigs are also important to many smallholders in the tropics. Pig rearing under traditional scavenging systems is generally regarded by farmers as a low-input, low-risk enterprise.

However, most pig research around the world has tended to concentrate on intensive, high-input systems. These may be successful on a large commercial scale, but are generally inappropriate for farmers with limited access to capital and other resources.

The situation is similar for poultry. Broiler chickens and eggs are now often produced in high-input, intensive, heavily capitalized systems. It is certainly hard to justify public financing of research on such systems in countries where farmers can't afford the necessary inputs.

In recent years, "microlivestock" have caught the attention of both researchers and development workers. The term includes small species such as ducks, rabbits, and guinea pigs. They require little space and only minimal capital resources. They come in family meal sizes and a large part of their diet can be obtained from kitchen scraps and gathered fodder plants.

Research on farm animals is complex and often long-term. Research should be targeted at those components of production systems with the greatest potential payoff.

To do this, animal researchers must be attuned to the farmer's perception of the role played by various species in the overall farm system. Are they a source of family food and income? Or a live "bank" for accumulating readily available capital? Or a means of obtaining social prestige?

Pertinent research demands an understanding of the links between crops and

Photo: R. Charbonneau / IDRC



Livestock market in northern Peru.

animals—for example, feeding animals with crop residues and specially grown fodder, grazing animals on stubble and pastures, and using manure and draught power for crop production. For the most part, these interactions are poorly understood and further research is needed.

Feeds: highest priority

Insufficient feed is the main factor limiting animal production in developing countries. Research on improving the quantity and quality of feeds should receive the highest priority.

Pastures and forages are the cheapest and most abundant source of feed. The quality is often poor, however, and availability can vary widely throughout the year and between years. Improvements can be achieved through better management and feed conservation practices, and by introducing new plant species and cultivars. (See article, page 11.)

Animal feed shortages and increased pressures on the land from population growth have led to severe over-grazing in many regions. Widespread soil degradation and erosion have been the result.

The situation is especially serious in areas where there is common access to grazing lands. In dry, marginal environments, this is believed to be a major factor in desertification. Agroforestry techniques, among others, hold promise of alleviating the situation.

In wetter environments, perennial species (trees and shrubs) can help to provide animal feed, as well as food, fuel, and timber. They also serve as windbreaks, provide shade, and reduce erosion. Alley cropping, whereby crops are grown between rows of trees or shrubs, is a particularly promising technique and has captured the attention of researchers in many regions.

Crop residues and agro-industrial by-products account for an estimated 25 percent of ruminant feed worldwide. During the dry season in Africa, 70 percent of ruminants depend on crop residues such as straw and husks. Putting farm resources to such use is an efficient and ecologically sound practice, especially when the feed is produced and consumed right on the farm.

The importance of by-products is growing as the number of animals increases and the amount of grazing land declines. Nevertheless, there are several problems associated with the use of by-products, including farmers' unwillingness to process or handle them. Further research is needed



Nepali women tending goats.

Photo: C. Devendra / IDRC

to improve digestibility and nutritional value, and to overcome storage and transport difficulties.

Research is also needed on other aspects of animal husbandry related to productivity—for example, improved housing, grazing, weaning, and milking practices.

Animal breeding research has been given considerable attention worldwide. But it has generally failed to provide sustainable long-term benefits to smallholders in developing countries. The potential productivity of many indigenous breeds hasn't yet been fully exploited, and exotic breeds haven't always lived up to their full genetic potential, especially when introduced into low-management systems. Crossbreeding has been generally found to be a better method of genetic improvement than direct introduction of exotic breeds.

Animal diseases are a major constraint on smallholder productivity in the Third World. An estimated 40 to 50 percent of buffalo calves in Bangladesh die before six months of age, and in East Africa up to 30 percent of the calves born in traditional livestock systems die of East Coast Fever in their first year.

Around the world, both the public and private sectors allocate substantial resources to animal diseases research, especially the development of vaccines and veterinary medicines. Unfortunately, less attention is generally given to the effects of management techniques on animal health and to the economics of different treatment methods. It may be, for example, that strategic applications of a drug are an effective and economical way for a small farmer to control animals' internal parasites, while regular doses throughout the year are not. Research into the most economical management practices is of

limited interest to commercial chemical and drug companies.

Crops vs animals

In summary, much remains to be done in the area of livestock development. At the international level, crops research receives considerably more resources than animals research. Within the world research network operated by the Consultative Group on International Agricultural Research (CGIAR), for example, only two institutions are exclusively devoted to livestock and both are in Africa. Two others have animal-related research sub-programs.

The CGIAR system devotes less than 15 percent of its budget to animals research and this is unlikely to change in the near future.

Outside CGIAR, there are likewise few globally mandated institutions devoted to animal research. Several, however, such as the International Centre for Research in Agroforestry (ICRAF), in Kenya, are making important contributions to the field, and many regional organizations have animal research programs.

Within the agricultural research systems of individual countries, there is again a far greater emphasis on crops research than on animals. Donor organizations would do well to devote more resources to help strengthen animal research within national-level programs. ■

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FIESTA FOR SIX: ONE GUINEA PIG

... AND WE'LL ALL BE FULL

Photos: R. Charbonneau / IDRC



Peruvians love to eat guinea pigs. In fact, they raise them right in their kitchens. A team of IDRC-supported researchers in Lima has developed new breeds of guinea pig that weigh three times more than some wild breeds and can feed six people. The scientists have also come up with better production techniques to meet the demand for this increasingly popular meat.

Left, 13-year-old Nilda Quiroz Perez, of Llacanora, Peru, is in charge of her family's guinea pig operation.

Right, guinea pigs are traditionally kept under the kitchen stove and fed table scraps.



ROBERT CHARBONNEAU

Around the world, lawsuits between neighbours, usually over property lines, are part of everyday rural life. In Peru, the lawyers who take these cases are said to be gorged on "cuys"—or guinea pigs—which they often receive as payment for their legal services rather than cash.

Usually thought of as a common laboratory animal, the guinea pig is the object of a whole mythology in the Andean sierra. Even as far back as the days of the Inca Empire, this pudgy rodent with its squeaking cry ("cuy, cuy") had established an important place for itself. . . at the dinner table.

In the cathedral of the city of Cusco, the "navel" of the Inca Empire, hangs a huge painting of the Last Supper. Surrounded by his 12 apostles, Jesus Christ sits at the table with a well roasted guinea pig in front of him which he is sharing with his guests.

Many Peruvians, whether from the mountains or the coast or just recently arrived in the suburbs of Lima, serve guinea pig as the favourite dish at their fiestas. The more valued a friend, the larger the portion. Any occasion—a visit, birthday party, holiday—is an excuse to serve up this tasty meat, usually fried, but also grilled, in a casserole, or in a soup.

The people of the Andean sierra get a significant proportion of their animal protein from guinea pigs. More than three-quarters of the inhabitants of Lima have eaten one at some time or another, and more than half the city's population breeds them at home. Improving the marketing of guinea pigs could easily increase consumption in the capital. A survey has shown that the supply in Lima is irregular and that the guinea pigs are sold live, which puts off some potential consumers.

Guinea pigs are linked with cooking, celebration, and myth. One belief is that eating black guinea pigs will make arthritis disappear.

Most people who raise guinea pigs do so

for their own consumption or to exchange them for other food such as rice. These "microlivestock" are still raised in the traditional way, close to the heat of the hearth. It is a family activity, mainly the responsibility of women and children.

In Peru, often as many as several dozen animals are allowed to live under the household stove, though sometimes they are kept in little enclosures built of adobe bricks. They are fed on table scraps such as potato peelings, carrots, and lettuce, as well as on banana leaves, alfalfa, and various grains bought for them at the market.

Guinea pigs are easy to raise and they breed rapidly. They are domesticated and don't run off, even if they get the chance. Being timid, they hide at the slightest movement made by their owners or visitors.

People believe that guinea pigs love smoke and heat, which is why they set them up in the kitchen. The truth is that these animals have imperfect cooling systems. Biologists agree that they can withstand temperatures close to freezing, but the heat kills them quite easily, sometimes in less than 20 minutes.

Contrary to what one might imagine, guinea pigs are not a minor species in this part of the world. Peru alone has 22 million of them. They are also eaten by the highland people of Bolivia, Colombia, and Ecuador.

After a gestation period of 67 days, the females produce litters with an average of three young, though the number can easily be as high as eight. Seven females can produce 72 offspring a year, yielding a total of more than 35 kilograms of meat. In Peru alone, 65 million of them are killed every year to produce a total of 17 000 tonnes of meat.

Researchers Lilia Chauca and Marco Zalvidar are devotees of guinea pigs. They have spent 15 years studying them at the experimental station at La Molina in the suburbs of Lima and are playing an active role in breed improvement.

It is said that at the time of the Spanish Conquest, guinea pigs grew to be 35 centimetres long. Nowadays, most adults don't reach even half that length. By careful selection of breeds and controlled crossing, the researchers have managed to "move backwards in time" and produce large guinea pigs.

Four types of guinea pig have been developed and are now being evaluated for their adaptability to varied regions and breeding conditions. The animals were selected for the speed with which they gained weight, but their disposition was also taken into account. Calm, docile animals are preferred over more nervous or stressed ones. These characteristics are important if the guinea pigs are to be raised in the kitchen.

The researchers began their work at La Molina station where they have two breeding enclosures that can hold up to 2600 animals. They developed breeds of guinea pig and evaluated their food consumption and growth rates.

Guinea pigs reach adulthood at about four months of age. At La Molina station, they attain a weight of about 1.1 kilograms at three months and, once fattened up, a single guinea pig can feed as many as six people. By contrast, wild Creole guinea pigs weigh less than half a kilogram at three months.

According to Dr Zaldivar, the demand for guinea pigs is on the rise. He is thinking of developing a nationwide Peruvian



Left, every week improved guinea pigs are shipped out of La Molina research station into the surrounding region.

Right, Julio Gamarra, a researcher from northern Peru, displays a fine specimen. Mr Gamarra regularly visits small guinea pig operations in his region to teach appropriate production methods.



network for breeding "supermales" and selling them to peasants. "To do that we'll have to develop animals that are perfectly adapted to the ecological conditions in the various regions of the country—animals for the coast and others for the sierra. We have developed breeds and simple techniques for raising them which make it possible to triple meat production without increasing the number of animals. Where producers now get three or four females a year by breeding, it is possible to produce as many as 10 animals."

These improvements stem from detailed selection and better feeding. The new breeds grow faster and are larger. In addition, their breeding cycle has been shortened. Females reach sexual maturity at between 6 and 8 weeks instead of at 13, males at between 9 and 10 weeks instead of 12. With a little care, such as washing the animals to rid them of parasites, producers benefit from the prolific nature of guinea pigs.

Dr Chauca, who heads the research project, recommends early weaning and the separation of males from females. One enclosure can be used for breeding—a single male services a group of seven or eight females. Another enclosure can house the young guinea pigs and remaining adult females. "Sometimes there's a problem getting people to accept the idea of raising guinea pigs in small enclosures," explains Dr Chauca. "Producers, particularly in the central region of the country, believe that guinea pigs breed better running free. But what happens is that the males fight for the females and the number of abortions is high." Uncontrolled breeding also leads to inbreeding which produces offspring with low resistance to a variety of diseases.

Dr Chauca has proposed a series of simple methods for families which raise guinea pigs at home. These suggestions have been built into courses attended mainly by women and adolescents like Nilda Quiroz Perez, of Llacanora, near Cajamarca in the north of Peru.

Nilda is 13 and looks after the guinea pigs owned by her family. "I haven't got many animals just now because we had a big party and had to kill about 20," she explains to a visitor while showing him her finest specimens.

One thing the women and children have learned is to identify pregnant females which all too often get thrown into the stew pot by mistake. Pregnant guinea pigs can be distinguished by their slow movements and portly look. "This simple aspect of raising guinea pigs greatly modifies a family's level of meat production," says Julio Gamarra, project researcher for the Cajamarca region, a rich agricultural valley in the North of Peru.

Dr Gamarra works in the region with about 15 families that raise guinea pigs. "A peasant will often have only males, because invariably he catches pregnant ones," he says. The researchers give producers a supermale bred at the station in exchange for another male. That protects the animals from degenerating as the result of inbreeding. "The peasants are usually pleased. But if things don't work out, we promise to hold a barbecue for them!"

Dr Gamarra takes his time. He knows that developing a farm-based production project is full of surprises.

"Sometimes all the animals we've marked get eaten between one visit and the next, which makes it impossible to keep up our research (weighing animals or checking their state of health). Sometimes too, the people are reserved. They don't like someone coming and telling them what to do. That's perfectly normal. They have to be won over. Only after that's been done can the work begin.

"I visit them every week. The first six months gives me the chance to observe their production methods. Then I spend the next six months trying gently to change how they do things."

The peasant women and their children then learn the rudiments of the improved production system: how to separate out the pregnant females, when to wean the young ones, and how and what to feed them. The researchers recommend, for example, that the animals be fed two or three times a day rather than once. This speeds up their weight gain.

The women and children also learn the importance of cleaning up the guinea pigs' droppings and washing the animals to keep them free of parasites. The droppings give off heat which is harmful to the animals and can spread a number of human diseases—salmonellosis, for example.

In the village of Jesus, Julio Gamarra has been working with a "cuyeria", a little restaurant that serves a clientele of guinea pig meat lovers. Thanks to Dr Gamarra, the owner is raising more than 100 of the larger "improved" guinea pigs in his backyard.

Dr Gamarra is also helping out Julia and Herrero Pastor, both carpenters. They keep rabbits in raised hutches in their barn, while the guinea pigs occupy the floor. Thus, the guinea pigs can pick up any food that falls from the hutches. It is a simple way to integrate two kinds of animal production without taking up too much space.

These few techniques have provided the peasants of Cajamarca, Junin, Huancayo, Puno, and Lima with a simple way to improve their diet and, in some cases, their income. The only real losers are the guinea pigs whose life expectancy is shrinking inexorably from seven years to only few months. But who among the guests at the fiesta is going to complain about such research results?

A COW'S BARN IS HER CASTLE

BETTER FORAGE, SHELTER AND CARE



Photo: Denis Marchand

Putting livestock in their place: Stabling cattle for a few hours a day helps farmers to control their feeding and weight gain.

DENIS MARCHAND

The Kisozi region of Burundi rises to an altitude of 2200 metres. It is only 90 kilometres from Bujumbura, the capital of this tiny Central African country, but the trip takes more than two hours by car.

The road to Kisozi is narrow and winding, filled with mud and strewn with rocks and roots. Washed down by the seasonal rains, all this debris is becoming as much a part of the landscape as landslides and farmland erosion.

The forests have almost completely dis-

appeared from the slopes which are very steep in places. They have given way to housing, commercial tea plantations, and subsistence crops. Every bit of land is used. With 147 people per square kilometre, the area is the country's most densely populated.

Farm holdings are generally very small—not much bigger than two hectares. Despite this, agriculture is the main activity of the local people, providing them with the means of survival and income.

On market days the women and children bring the surplus of corn, bananas, pota-

toes, and cassava from the fields to the main road. There it is picked up by trucks and taken to market in Bujumbura.

In the glens of the high plateaus, cattle graze lazily. Wandering freely on communal pastures, these animals belong to the small farmers of the Kisozi region. Most of the cattle are of the Ankole breed, characterized by enormous horns. Unfortunately, it is known for its low productivity.

"I used to let my cows graze on poor-quality pasture infested with parasites," says a farmer named Janvier. "Only half

their calves survived initially and, of those, half died in their first year. Now I realize that if I want healthy animals, they must have nutritious diets. These days I take better care of my cattle," says Janvier, pointing at two well fed cows eating cornhusks.

Janvier is one of the eight farmers who volunteered in 1984 to work with the Institute of Agricultural Sciences of Burundi (ISABU) to test a new cattle production system integrated with agriculture. As with the other farmers, ISABU provided Janvier the poles to build a barn with stalls and gave him a crossbred Ankole-Sahiwal cow in exchange for one of his Ankole cows.

Easier manure collection

The cattle graze for several hours a day in natural pastures. They spend the rest of their time in the barn stalls which makes it possible, among other things, to check their state of health, provide them with a rich and complete diet, groom their coats, rid them of ticks, and collect manure for use as fertilizer.

The manure is important to improving soil fertility and, therefore, crop production. It is placed in a shallow pit and covered to protect it from the rain which would otherwise leach out the nutrients. After accumulating manure for a year, the

farmers spread it on their maize and other crops or mix it with topsoil when the land is being prepared.

On carefully tended narrow lots, Janvier now grows his own forage crop, *Seteria splendida*, between the cassava and corn. The forage, which is grown in hedges, also helps to retain the soil on slopes. The other farmers have also planted Guatemala grass for forage.

To feed his cattle during the fallow season, Janvier stores his surplus forage in a deep hole which he covers with a thick layer of straw, followed by earth. Although this is a remarkably simple method, experiments by ISABU have shown that it is effective and conserves the silage for more than six months.

"We have no choice but to improve the system of raising cattle in Burundi—it has to be done," asserts Mathias Banzira, a researcher at ISABU. He explains that better management of cattle will do more than increase the production of meat and milk. It will also improve crop yields and reduce erosion of slopes by providing a cover of vegetation. "Although feeding cattle in barns constitutes a radical departure from traditional practice, the program has already been more successful with the farmers than we expected," adds Mr Banzira.

There are now about 50 experimental

farms like Janvier's. Most of the animals are in excellent health and their productivity has gone up considerably compared with cattle left to roam. The sale of milk and calves provides farmers with a sizable income, enabling them to buy more cows. The farmers who have been with the project since 1984 when it began now have two or three offspring of the Ankole-Sahiwal crossbreeds and are selling off some of their Ankole cattle.

According to Jean Berchmans Berahimo, the ISABU's head of animal production, the project meets obvious economic and nutritional needs. First, Burundi annually imports more than 1000 tonnes of powdered milk. Secondly, annual consumption of meat is less than 5 kilograms per person, and milk consumption is only 7 1/2 litres.

Greater numbers needed

There is still a way to go before this cattle production system is widely adopted. The research project is only one stage in a program to intensify cattle raising in Burundi. The animals still have to be bred in much greater numbers.

"We are snowed under with requests from farmers who have seen the results on the experimental farms and want to buy selected animals," says Mr Berahimo. "To meet the demand, the breeding centre would have to produce 400 head a year, whereas its present capability is limited to about 100."

Widespread dissemination of the program will require at least 500 breeders on the hoof. Two ISABU technicians are scheduled to be trained in Canada in the techniques of artificial insemination. On their return, they will work in Kisozi and at the Mahwa Livestock Research Station.

To date, ISABU experiments have shown that the Sahiwal-Ankole crosses are more disease resistant and more adaptable to the environment than the temperate breeds of cattle.

But Mr Berahimo's concerns go even further. As he sees it, increasing national milk production is simply one step leading to the establishment of policies on the processing and marketing of agricultural foods. "Even if our dairy system is currently operating below capacity, we have to start thinking about setting up a network for sales on the home market. Couldn't the 400 million Burundian francs we now spend on importing milk products be better spent on the processing industry?" ■



Surplus forage is placed in a hole and covered with straw and earth to preserve it. Farmers with the necessary resources construct stone-and-mortar walls around their store.

Denis Marchand is a Canadian freelance photographer and journalist based in Montreal.

GREEN FEED FOR BALI CATTLE

INDONESIA'S THREE STRATA FORAGE SYSTEM

ROBERT INNESS

Farm families on the Indonesian island of Bali cultivate small plots of land but invariably also have two or three steers for draught and meat and one cow for breeding. When cattle reach between 375 and 400 kilograms, they are sold.

'Cattle are like money in the bank and less risky than crops,' explains a group of farmers now working with researchers from the Udayana State University in Denpasar, Bali. The only breed raised on the island is called *Banteng*, also referred to simply as Bali cattle. These are an entirely different species from European and African cattle, and are especially well adapted to the hot, humid climate of Indonesia. Two notable characteristics of *Banteng* cattle are their ability to survive on poor pasture land and their lean, tender meat which makes them attractive to export markets such as Hong Kong and Japan. (See *Reports*, October 1985, p. 9.)

The university research team, headed by Dr I. Made Nitis, believes that the traditional system of cattle rearing can be modified to benefit subsistence farmers, as well as the island's economy and ecology. The new idea they are counting on is called Three Strata Forage—or TSF for short. It is a system of feeding cattle from three sources of vegetation that can be grown by the farmers right on the farm.

According to a review of the progress made to date, conducted by an independent group of evaluators in early 1987, there are good reasons to be optimistic. "... TSF is a good strategy to provide more diversity of crops and forages which will be available throughout the year," writes Mr Inu G. Ismail, an Indonesian agronomist and member of the evaluation team. "It will directly support the government policy to increase the population of Bali cattle."

Another evaluator, Filipino animal scientist Dr Cecilio R. Arboleda, writes: "In its three years of project implementation, the Three-Strata Forage project has shown that the income and profitability of small-holder farmers... could be improved by planting forage trees, shrubs and grasses along with the traditional food crops and livestock in their farming systems."

Between 60 and 70 percent of Bali's

population of 2.7 million live in rural areas. Farm holdings are rarely larger than 2 hectares per family. It is common practice to plant corn, cassava, soybean, or a combination of these.

Farmers don't usually plow right to the edge of their plot, but normally leave "live fences" consisting of cactus and trees. Some fields are left fallow each year and these are often used to tether cattle which feed on any available grass or other green roughage. In the dry season, there is less grass immediately available, so farmers supplement the animals' feed with tree leaves and grasses collected from lowland farms up to 10 kilometres away. Under this traditional grazing and feeding system, Bali cattle gain weight relatively slowly—from 100 to 200 grams a day. At that rate, it takes them four to six years to reach marketable weight.

Bali's human population is increasing rapidly. At current growth rates, it will be 30 percent larger by the year 2000. There will thus be pressure to reduce either the stocking rates or the amount of land used to feed cattle. In either case, an important and stable source of income for Bali's poorest farmers will be threatened.

Between 1977 and 1984, IDRC funded a research project to develop improved methods for feeding cattle. It was led by Dr Nitis of Udayana State University. His research team showed that Bali cattle can record weight gains of 400 to 500 grams per day when their diets are supplemented with crop by-products such as rice bran and other concentrated forms of protein. At this growth rate, *Banteng* cattle reach marketable weight in two to three years instead of four to six.

The system demonstrated by Dr Nitis and his colleagues, however, was rather demanding in terms of costs and labour. In 1985, they therefore proposed the Three Strata Forage system, a less expensive alternative feeding method. TSF uses cuttings of selected grasses, shrubs, and trees—that is, protein-rich biomass from three levels or "strata" of forage. The TSF project has been funded by IDRC since 1985.

The project grew up around a group of farmers in the Bukit Peninsula who were willing to participate in a six-year study using 16 hectares of land that they leased to

Photo: Ken MacKay / IDRC



Bali cattle: Adapted to humid tropics.

the project. The farmers were instrumental in designing the 64 plots that would be used to compare the traditional cattle forage methods with the TSF system, using 48 head of Bali cattle. Aside from monitoring and analysis, it has been the farmers who have set and enforced the regulations needed to ensure experimentally sound results.

Under the TSF system, the animals' diet changes systematically with the seasons. During the wet season (December to March) and early in the dry season, the cattle feed on grasses and legumes. From early to mid dry season, they eat mainly green fodder cut from shrubs, and during the rest of the dry season and early in the next rainy season, they feed on tree leaves, supplemented by fodder stored earlier. Fundamentally, TSF is a way to make green roughage available to cattle all year round.

High-protein forage plants

A number of the recommended species in the TSF system are leguminous, including some of the shrubs and trees. Such plants have the ability to fix nitrogen which fertilizes the soil for the non-leguminous species. An additional benefit to the cattle is the high protein content of the legume species.

The research team hypothesized that the TSF cattle would record gains of 300 grams per day. In fact, they gained only 230 grams a day during the 1986 wet season—which is still better than the 200 grams a day for the cattle tethered in the traditional manner.

The origin of the cattle seems to have been a factor. Some of the Bali cattle purchased for the test originated from another area of Bali and found the shrub *Gliricidia*,

one of the experimental fodders, to be unpalatable. Those Bali cattle that had been born and raised in the immediate test area, however, didn't have any problem with it.

As compensation for lower-than-expected weight gains, farmers were able to stock more cattle under TSF. Additionally, more feed was being stored for use in the dry season—a period when animals grazed the traditional way normally lose weight.

Farmers preferred TSF's stall feeding method over the practice of tethering because it saved time and made it easier to collect manure. They noted, though, that the TSF cattle, having been deprived of the handling associated with tethering, were wilder. And, because the open stalls exposed the animals to the natural elements, the TSF cattle were also more prone to disease.

The TSF system has been modified to overcome these difficulties. Cattle are now housed in roofed sheds and, to make them more manageable, they are walked to water once a day.

The impact of the new techniques is just beginning to be felt, in the view of the six-member evaluation team. Not only have farmers from 60 percent of farm associations in the region visited the test site, but many of the plant species used in the project

have been disseminated through a nearby nursery.

Farmers in and near the project area have begun to substitute the shrub *Gliricidia* for cactus, the traditional living fence species. Tracts of sloping land that have been steadily eroded by wind and water have been targeted by farmers as ideal sites for pure stands of the trees and shrubs promoted in the project.

Among other things, the evaluators recommend that the researchers make the TSF system as flexible as possible by giving farmers a wider choice of fodder species to plant. Perhaps their most important observation, though, is the need for the research team to strengthen its understanding of the socioeconomic aspects of both TSF and existing farming systems in Bali. By doing so, they will improve the chances of TSF being tried out by other Indonesian farmers. As evaluator Brian Carson, a Canadian soil scientist, observed: "The in-depth documentation and study of physical and socioeconomic characteristics of the farming systems of the project area could provide a springboard for the expansion of the technology to similar agroecosystems throughout Indonesia." ■

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Photos: C. Devendra / IDRC



A young Pakistani grazes his flock of sheep and goats on the stubble of a harvested grain crop.

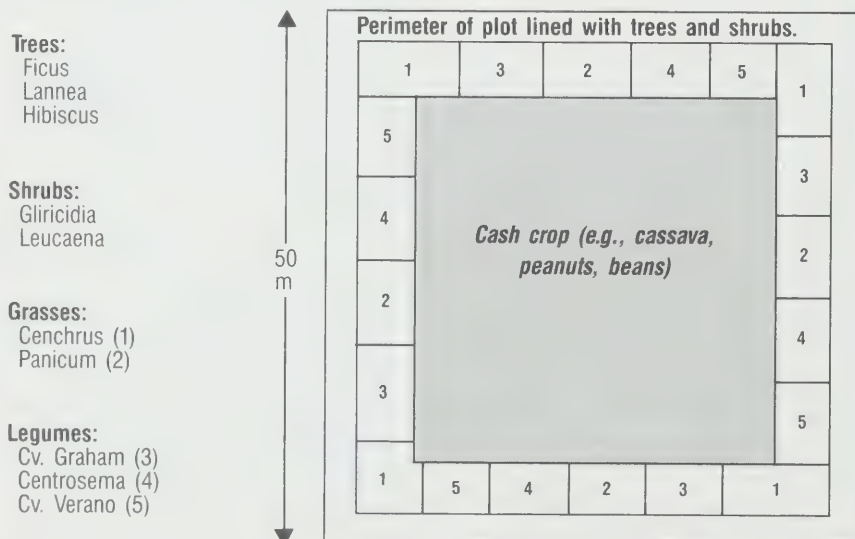
AN IDEAL PLOT

Under the Three Strata Forage system, farmers make changes to only about one third of their land in order to increase forage production.

An ideal TSF plot would be 50 by 50 metres, or a quarter hectare. The core area of 40 by 40 metres is planted to traditional cash or food crops such as peanuts, cassava, corn, soybeans, and

sorghum. The surrounding 5-metre-wide strip is reserved for three kinds of cattle forage: grasses and legumes; shrubs; and trees.

The TSF system is not meant to be rigid. Rather, farmers can adapt the shape of the plot and the combination of forage species to their own circumstances.



FRIENDS OF THE FAMILY

THE IMPORTANCE OF GOATS AND SHEEP

Mexican girls with homemade goat's cheese.



C. DEVENDRA

Goats and sheep are found on millions of small farms throughout the developing world—and often in the cities too. In the lingo of the animal scientist, they are “small ruminants”.

A ruminant is a mammal that chews its cud and has a stomach with four separate compartments for digesting food. In addition to goats and sheep, ruminants include larger animals—buffaloes, cattle, camels, llamas, alpacas, and yaks.

Nearly all of the world's goats (94 percent) and over half of its sheep (52 percent) are found in the developing countries. They contribute in numerous ways to the well-being of people, especially small farmers and landless agricultural labourers.

First of all, goats and sheep are an important source of milk and meat. Goat's milk can be processed into cheese, yo-

ghurt, butter, ghee (semifluid clarified butter), and sweets. Secondly, these animals forage on a wide variety of plants, including crop residues such as cassava leaves and cereal straws. Thirdly, when they are penned in farmers' fields, they give fertilizer for food crops in the form of dung and urine. Lastly, they provide skins, hair, and wool from which to make clothing and handicrafts.

These qualities make goats and sheep valuable and versatile commodities. They can be bought and sold for security and income, and rearing and tending them create employment.

Women and children are usually involved in the management of goats and sheep. This role, often underestimated, is of great benefit to the economic stability of households and small farm systems. Evidence of this can be seen in Africa, the Near East, the Indian subcontinent, Southeast Asia, and the altiplano regions of Latin America.

The management role of women and children is associated with two main benefits: family income and human nutrition. Income from rearing goats and sheep enables women to cover a number of household expenses such as school uniforms, shoes, medicine for sick children, and ceremonial occasions. Goat meat and

milk products help to promote nutrition and health. This supply of animal protein is particularly important to pregnant and nursing mothers and the young.

Goats and sheep provide employment for landless farm labourers who are paid to take the animals out to graze daily. Children too are often given the job of shepherding outside school hours. This provides them with companionship and engenders in them a sense of responsibility and even affection.

Ownership of animals provides security to women in the event of divorce or seasonal migration of the husband. In many countries, it also brings respect in the community. The more animals, the greater the prestige—and the easier it is to meet social obligations such as providing gifts or food for ceremonies and feasts.

With better use of family labour, it may be possible to intensify production of goats and sheep. The social and economic benefits of raising and owning these species need to be more widely studied by researchers concerned with rural development and with improving the lot of poor people in the Third World. ■

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Nepali children carrying forage to feed their goats.

WOOLY SURVIVORS

Photos: R. Charbonneau / IDRC



Flock of alpacas in Peru's altiplano region.

ROBERT CHARBONNEAU

Looking like spots on a huge tapestry, 100 or so alpacas are grazing on the sparse pasture of a steep slope, some 4800 metres above sea level. A few metres from them erosion has already begun its destructive work: a brown flow of sand and soil slides into the torrent at the bottom of the valley. Overhead, almost within reach, a black cloud is ready to bombard the landscape with hailstones.

This is the Nunoa region of Peru, half way between the cities of Cuzco and Puno on the high plateau, known as the "altiplano". Huge valleys carpeted with green and gold pastures stretch away to the horizon.

Despite the great altitude which leaves visitors breathless, Dr Victor Leyva talks with excitement, unaffected by the rarified air. Eleven years ago, the stocky Peruvian moved away from Lima and settled into a research station at La Raya, a few hours down the road at a lower elevation. His belief in his research project has never

flagged. He studies production systems for camelids, especially the alpaca whose woolly hair is the main source of income for local livestock owners.

La Raya station is operated by the Instituto Veterinario de Investigaciones Tropicales y de Altura (veterinary institute of tropical and highland research), or IVITA, for short. Over the years, Dr Leyva and his colleagues at the station have developed a series of simple techniques for raising camelids.

In 1984, IDRC responded to a request from the researchers to work with local farmers in order to validate earlier work on the station, (also supported by IDRC). "The on-station results had been excellent," says Dr Leyva who heads the project. "What we needed next was to start dealing with the small producers in the region to find out what was likely to work."

The second phase in 1984 began with a study based on a sample of 82 alpaca producers. These participants were all in the Nunoa region which has a total of

150 000 alpacas, as well as small flocks of sheep. Some two hundred producers in the valley derive most of their income from alpaca, mainly by selling the fibre but also from the meat. Thirty percent of the alpaca farmers have already set up trading cooperatives.

The study enabled the researchers to evaluate the commonest production practices. It was complemented by a monitoring study of six alpaca operations (four small and two medium-sized ones) to determine production cycles, levels of income, and acquired habits.

"We had a model to propose to the producers," says Dr Leyva. "The study showed that close to half the producers came fairly close to our recommendations and that the other half could make real gains by applying some simple techniques. We believe producers in the region could easily double their income. The price of alpaca fibre nearly tripled in the four months from September to December. That's certainly a market with a future."

In the village, alpaca fetuses are part of the folklore. They are bought in the market so that the local sorcerer can burn them as an offering to the gods. "Para pagar la tierra (to pay for the land)," say the elders. The fact is that alpacas have a particularly high miscarriage rate. The reason is that males and pregnant females remain in the fields together without any supervision. If a male indiscriminately mates with a pregnant female, it puts the fetus at risk.

The alpaca birthrate is very low. Only 42 to 45 percent of the producers' female alpacas carry their calves to term. Simply separating pregnant females from the flock leads to a notable improvement: the birthrate easily climbs to 60 percent. The separation has to be maintained for about 10 days after birth to allow the mother some rest.

Separating the males and females reduces infections and makes it possible to control the number of births. Efforts can also be made to ensure that alpaca calves are born around April when forage is at its



Left, Victor Leyva and his team in a field of *Falaris* grass.

Immediate right, alpaca producer and son. Far right, woman selling alpaca fetuses in the market at Sicuani. Peasants burn them as an offering to the gods.



richest and most abundant.

Attempting to reduce the number of miscarriages is a reflection of the researchers' concern with preserving this particularly fragile species which has a very long gestation period—342 days.

The researchers have also discovered that young alpacas should be weaned after seven or eight months. By then they are ready to eat forage. Allowing the mothers' milk supply to dry up between births is important. It forces the calves on to a forage diet, eliminating the inclination to steal milk after the birth of the next generation. The researchers have determined that it takes three weeks for lactation to cease in the females. As a bonus, the females can produce up to 10 percent more fibre once lactation stops.

Though veterinarians by profession, the researchers don't lose sight of the social and economic limitations on alpaca production. They are aware that the peasants are short of labour and try to make the weaning period coincide with school vacation at the end of July.

The researchers have had the opportunity to observe the effects of their recommendations on the producers' operations. With some of them, the birthrate has gone up from 45 to 82 percent and the mortality among young animals has dropped from 27 to 17 percent.

Other practices have also been proposed. Alpacas graze all day on the slopes, but they return systematically to certain areas to defecate and sleep. After a while, forage no longer grows on these "dormideros". By forcing the animals to change their dormideros every five days (either by erecting a corral or leading the flock elsewhere), precious forage can be preserved and the benefits of the dung are spread out.

The researchers have also taken an interest in the control of parasites that attack alpacas, some of which make the hair fall out. The researchers recommend that the animals not be allowed to graze in low-lying areas from January to March, the area

and time in which parasites are more numerous.

Additionally, a study of some of the producers has shown that income from the sale of alpaca fibre fluctuates widely. The animals are sheared only every 16 to 24 months. The researchers have suggested, instead, shearing half of them every year so as to help to stabilize producer income.

Victor Leyva and his team had to win the confidence of the producers in the region. "You find mistrust everywhere. The peasants quite rightly fear outsiders. Some of them are visited by the armed revolutionaries of the Sendero Luminoso (Shining Path), a Maoist group. Even our research station at La Raya isn't safe from terrorists. Bombs went off there four years ago."

Despite the difficulties, the research team managed to get more than 100 producers to come to the village assembly halls. "When we hold the first meeting we talk only about alpaca production in either Spanish or Quechua," says Dr Leyva. "We discuss, and above all, listen. Then our group meets to exchange and share the information collected."

Thus, the researchers get to know the local producers and their problems better. A second producers' meeting is called and the research team proposes a whole battery of solutions. This is done with the aid of large pictures which illustrate a variety of topics such as dividing the flocks or weaning the calves. The pictures are the work of a young artist from Sicuani, a town near La Raya station.

At a final meeting, the producers are invited to watch a 20-minute video on a topic such as treatment against parasites. Five such productions have been done in Quechua, Aymara, or Spanish on different aspects of raising alpaca. They were put together by the Centre for Training Studies (CESPAC) in cooperation with IDRC and IVITA.

The prospect of improved alpaca production methods raises an obvious question. What might be the ecological

consequences if more and more alpaca farmers in the region adopt the new practices and the number of animals begins to rise rapidly?

Dr Leyva makes no secret of the issue. At this altitude, the pasture is poor. "There are almost three animals per hectare already in the region. That's more than twice what the natural pastures can carry. We absolutely have to improve the natural pastures. We need to introduce legumes and grasses which are more productive such as *Trebol blanco* or *Falaris*."

Falaris grass seems to be particularly promising in moist soil at the bottom of slopes. Provided the animals don't get at it too soon, *Falaris* grows higher than one metre in the first year. The researchers recommend it as an integral part of the alpaca production system.

The producers clearly recognize that there are too many animals for the natural pastures. As for the researchers, they stress the point that their main purpose is to increase fibre production rather than the overall number of alpacas. "The best thing would be to select breeding animals (for their ability to produce fibre) and ship excess animals out of the region," says Dr Leyva.

The conduct of science in a farmer's field often brings surprises. "We had agreed to leave out certain villages when it came to recommending new technologies," recalls Dr Leyva, "because we needed a control group. Then the peasants began to insist on being visited too. People would ask: 'Why don't you do it with us?' Some of them even 'stole' some aspects of the technology we are developing. One producer from the control group proudly showed us his magnificent *Falaris* field."

"Until now, almost all the technology developed by other researchers has been aimed at the big producers. What we wanted to do was to reach the small producers in the region. When we've finished at Nunoa, we'll move on to two neighbouring regions where there are a total of 350 alpaca producers." ■

BOTSWANA'S NEW BREED

MILK AND BEEF FOR A DESERT COUNTRY



Photos: Doane Gregory

ROBIN COX and DOANE GREGORY

It's a bumpy ride to Mr Khunou Masisi's farm. The dirt track has been rutted and gouged by tires and water and its meandering through the flat, unending plain seems aimless.

New growth covers the red earth that only two weeks ago was barren, the result of a recent rain. But the green is deceiving. Thorny acacias and toxic weeds are the only plants to benefit from the meager offering as sub-Saharan Africa enters its seventh year of drought.

Mr Masisi is one of hundreds of subsistence or below-subsistence farmers struggling to survive on the marginal arable land of his native Botswana. The bushveld on

which the majority of Botswana's one million people lives comprises only one-fifth of the country's landmass of 582,000 square kilometres. The remainder of the landlocked Southern African country is buried under desert sand. At the best of times, the Kalahari Desert can sprout lush green grasses; at the driest of times, it is a sea of sand with drifts of up to 100 metres deep.

Despite the harsh environment, Botswana boasts a relatively healthy economy, due in large part to its enormous reserves of diamonds and annual exports of four million carats. But if diamonds are the modern measure of the country's economic stability, traditional economic pow-

er in Botswana is measured by the size of one's herd of cattle.

Directly or indirectly, Botswana's 2.5 million cattle support 80 to 85 percent of the population. Despite ongoing drought, beef cattle production in this country is more commercial and advanced than in most developing nations. Apart from South Africa, Botswana is the only Southern African country to export fresh meat to the European Community.

"Botswana are really cattle people," says Dr Berhani Kiflewahid. "This country is basically one big ranch."

Dr Kiflewahid is the project advisor for the Dairy/Beef Production Systems Research Project currently entering its second three-year phase. The project, funded by IDRC and the Botswana government, is part of the Ministry of Agriculture's six-year national development plan. The goal behind the project is to increase milk production by peri-urban small-scale farmers like Mr Masisi.

Previous attempts to increase beef production by these same farmers have failed, but the dairy project, because of its ability to demonstrate immediate benefits to the farmers, is already deemed a success. The aim is not only to increase local supplies for home consumption—thereby boosting the nutrition and health of the rural people—but also eventually to meet the demand of the country's rapidly growing urban population.

In 1985, Botswana imported 80 percent of its fresh milk needs and all of its other milk by-products at a cost of 11 million pula (US\$7.5 million). Increased dairy production should not only diversify and increase rural incomes, but also cut down Botswana's dependence on other countries, particularly South Africa.

The small-scale dairy production research project was established in the traditional farming area of the Gaborone region in 1985. It began with research into the development of small-scale fodder production methods, and experimentation with higher yielding, crossbred heifers for introduction to small-scale cattle owners.

Mr Masisi is typical of the 12 farmers recruited in the first year and of the 28 who joined in the following two years. He lives with his family on a small, dusty farm outside Oodi, a township near Gaborone.



For the purposes of the research, all the participating farmers live within 20 kilometres of the capital.

Mr Masisi's homestead is a collection of small huts made from a mixture of cow dung and water. Most of the land available for farming in Botswana, including that surrounding Mr Masisi's farm, is tribally owned. In addition to those communal grazing areas, Mr Masisi has a 9-hectare field on which he grows mostly sorghum and millet, the major crops in this area. To join the research project, he also had to commit a hectare of his field to the planting of Lablab, a legume fodder crop.

One of the major thrusts of the project has been to introduce a new approach to cattle management which includes the growing of specialized fodder crops and the harvesting of crop residues. Traditionally, after the food crop harvest, farmers allow their cattle—and their neighbours'—to graze crop residues wherever they find them. Under the project, though, farmers are asked to harvest these residues to ensure they are fed specifically to their own animals.

Cattle herds in the area have shrunk over the past few years due to drought and the average number of head is currently about 15. Most of the participating farmers, including Mr Masisi, have at least 15 cattle.

Mrs Mmaleshaga Molefhe, one of the project participants, was once a wealthy woman, boasting 77 head. But her herd was devastated early on in the drought and

she joined the project in the second year with only three cows. Asked how important the project was to her, she responded, "Tahta!" or "Very much". It is, she says, "a chance to start over, a chance to feed my children."

Despite the ongoing drought, animal nutrition and health on the project farms have improved due to better crop management and increased tick control and vaccinations. But perhaps the most impressive factor of all is increased yield, thanks in part to the introduction of Simmental blood to the herds.

Tswana are the traditional breed of cattle in Botswana. They are a hardy Heinz 57 variety, well adapted to the environment of Botswana, but not a highly productive milk cow. In early research it was discovered that a Simmental/Tswana cross provided the necessary environmental adaptability while retaining flexibility—the milk yield went up and the animals could still be sold for beef.

Each farmer in the project, after proving a willingness to grow and harvest fodder crops, has been provided with one in-calf Simmental cross in exchange for a cow from his or her herd. The one-for-one swap not only increases the farmers' sense of commitment, but also helps to defray the cost of the project through the sale of the Tswana cows.

Now in his third year of the program, Mr Masisi is getting three to four times more milk from his cows than he used to.

Like all the farmers, he has been encouraged to milk twice a day and has been provided with calibrated plastic buckets for recording milk yield.

Total milk production by the initial 12 farmers for the first year was 14.1 tonnes, with each Simmental cross producing 2½ times more milk on average than each Tswana.

In order to ensure the continuation of these encouraging results, the project has made staff training and upgrading a top priority. Daisy Pelaelo is typical of this aim. She is fluent in both Setswana and English and her familiarity with farming and Batswana traditions allows Ms Pelaelo to deal with project farmers with ease.

She and others like her are the wave of the future for such projects and are being groomed to take over and carry on the work of expatriates like Dr Kiflewahid, who came to Botswana in 1985 from Canada.

Two members of the dairy research team are undertaking postgraduate degrees at the University of Guelph in Ontario, Canada, with the aid of IDRC. Ms Pelaelo and at least one other research worker are being considered for placements at other Canadian universities this year.

The final extent of the project's success will be difficult to assess as long as the drought continues to grip much of Africa. Under such adverse conditions, survival itself is a major accomplishment. Yet the participating farmers are seeing not only improved health and milk production in their herds, but also direct financial gain. As his own measure of the research project's success, Mr Masisi, who is 62, proudly points to the opening of his very first bank account.

To these farmers any extra "pula" can make an enormous difference—in more ways than one. In English, the word "pula", which is Botswana's monetary unit, means "let there be rain". In Botswana, where prosperity is synonymous with precipitation, this expression now has more poignancy than ever. ■

Batswana farmers participate in the research. Their cattle also serve as draft animals.



Robin Cox is a freelance journalist. Doane Gregory is a freelance photographer. Both reside in Vancouver, Canada, and recently travelled overland from Botswana to Kenya.

STARTING FROM SCRATCH

IMPROVING MOZAMBIQUE'S GROUNDNUT HARVEST

War-torn Mozambique is far from an ideal setting for the conduct of badly needed agricultural research. Yet determined efforts in recent years have produced a rare result: an all-Mozambican research team. Work to improve groundnut production is also promising, but the daily threat of attack prevents contact between young scientists and farmers.

RHODA METCALFE

A grey sky hangs heavily over the patchy acre of groundnuts. Dr R.K. Ramanaiah points down at one rectangular bed of brown earth from which a few leafy stems have straggled up.

"Only 15 plants lived out of the 200 seeds we planted. If none had survived we would have lost this variety," he says.

The field is nurturing hundreds of varieties of groundnuts (also called peanuts) which were collected from around Mozambique and the rest of Africa for a research project for which Dr Ramanaiah is advisor.

Replanting and harvesting the different varieties is not the easiest way to preserve seed samples—but then in Mozambique, a poor Southern African country ravaged by guerrilla warfare and famine, nothing comes easy.

In the first years of the groundnut project, financed by IDRC, the seeds were kept in a cold storage room. To survive, the seeds must be kept at around 4 degrees Centigrade. But frequent sabotaging of electrical power lines around Maputo, the capital, by the guerrillas or "armed bandits" have caused power failures of up to a month. During these blackouts, temperatures in the storage room would creep up to 25 degrees—deadly to seed samples.

Recognizing this problem, IDRC bought the project a diesel generator to fill the electricity gaps. Unfortunately, chronic shortages of supplies and services in Mozambique—for example, no cement to build housing for the generator and, later, no wiring to connect it up to the storage room—have kept the generator silent.

Against this backdrop of supply shortages and widespread violence in Mozambique, the groundnut project has nevertheless made quiet advances since its beginning in 1981. As Dr Ramanaiah points out though, "It isn't hard to advance when you're starting from scratch."

More than 75 percent of Mozambique's population depends on farming to survive and groundnuts are their main source of edible oil. The research project is the first attempt to improve groundnut quality and yields in Mozambique.

Prior to independence in 1975, the Portuguese colonial government directed



Photos: Rhoda Metcalfe

The research team has collected hundreds of varieties of groundnuts. Here, a local variety called bebianio has been grown by the government seed company at the researchers' request.



any agricultural monies at improving cash crops such as sugar, cashews, and cotton. "Groundnuts were a poor man's crop—a crop of the peasant farmer—so the Portuguese didn't bother with it," the project leader explains.

Neither did the colonial rulers bother to train Mozambicans in agricultural research. At independence, there was only one Mozambican agronomist in the country and the ranks of laboratory technicians and trained field workers were similarly empty. With a 93 percent illiteracy rate, the general level of education in the country was abysmally low.

Dr Ramanaiah began training from the bottom up. He hired 20 "sons of farmers with experience in the field" and taught them the basic skills of agricultural science such as identifying plant diseases, marking out land, and proper distribution of fertilizer. Of the 20 hired, 10 had a grade four education. "Some of the others signed their names with a thumbprint," the agronomist recalls.

The trainees were encouraged to upgrade their educations at night school and by phase two of the project in 1984, five of the most promising recruits were chosen for further training. Each received an IDRC scholarship for a six-month course in a specialized research area such as seed multiplication, plant breeding, or crop mixing, at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Hyderabad, India.

Most of the 80 recent graduates in agronomy from Maputo's Universidade de Eduardo Mondlane got their hands dirty in the field for the first time through the groundnut project. By conducting surveys among peasant farmers, the university students were forced to consider the practical needs of the farmers instead of keeping their heads in the laboratory, says Dr Ramanaiah.

Consider an example from Inhambane Province. The red soil is iron-rich and forms a hard crust as the iron oxidizes in the air. If the groundnut variety planted in this soil doesn't have a strong stem, the farmers must beat the earth around the plants in order to pull the submerged groundnuts up through the crust intact. Unless the agronomist has good communication lines with these farmers, he is like-

ly to breed a groundnut with a weak stem and then wonder why the farmers reject it, Dr Ramanaiah explains.

"It is a very hard thing beating the ground for hours to get a few groundnuts," he says. Even the monkeys know enough to jump from a tree onto the soil to loosen the crust before grabbing the nuts and running off, he adds.

Dr Ramanaiah is confident that by the time he returns to India at the end of his contract in 1990 the research team, Mozambican from the lowest skilled to the highest, will be ready to continue on its own.

"And an all-Mozambican research team is a rarity in this country," says the agronomist.

In addition to the training, the project has had one concrete victory. After collecting and testing local and imported groundnut samples, the researchers singled out the most suitable variety for each of the southern and northern halves of the country.

Under the typical farming conditions of no irrigation, pesticides, or commercial fertilizers, a local groundnut variety called bebianio was found to be the best choice for southern farmers. It yields at least one tonne per hectare in a good year and 0.5 to 0.7 tonnes per hectare in a dry year. This is 10 to 20 percent better than the major varieties imported from South Africa.

The real challenge to the researchers was convincing the government seed company that the bebianio variety was superior. "It took us six years to get the seed company to multiply the local groundnut variety. It is very difficult to convince people that local is better than imported," Dr Ramanaiah explains. "In my opinion, it will take four to five years before it (bebianio seed) reaches all the private farmers."

Seed multiplication is a slow operation and the National Seed Company does not currently produce enough seed for the entire southern half of the country. The company gives farming cooperatives first chance at obtaining groundnut seed on the agreement that the farmers refund the seed company twice the original quantity after harvest.

For the soils of northern Mozambique, the researchers found that varieties from

Senegal and Burkina Faso outperformed Mozambican seed.

The researchers had originally hoped that by the third phase of the project, from 1987 to 1990, they would expand research in three northern provinces creating a nationwide groundnut research program. Instead, the guerrilla war, waged by the South African-backed Mozambique National Resistance Movement (MNR), has forced the researchers to abandon their fieldwork in five provinces and retreat to the security of Maputo City.

In 1983, the groundnut researchers were shocked into realizing the danger posed by the MNR when two project workers disappeared in the southern province of Inhambane while touring farms to buy seed samples. Dr Ramanaiah found the project Land-Rover and two decomposing bodies 15 days later in the bush some 300 kilometres from Maputo. Since then the violence has spread.

The danger of being ambushed along Mozambican roads has become so great in recent years that many foreign governments forbid their employees to travel between cities by car. Maintaining distant research bases under these conditions is too costly and impractical for the groundnut project. "You need to wait 15 days to arrange a plane to take you for a four-hour visit at a research station," says Dr Ramanaiah.

After seven years of training, the research team is at the point where they should be working intensively with the farmers, says the project leader. They should be studying the diverse farming practices and soil conditions, and the farmers' use of draught animals. They should be testing new ideas to improve crop production.

"The farmers are our technicians, their animals are our experimental animals," says Dr Ramanaiah. Or they would be if the researchers could get to them. Like all development projects in the country, the groundnut project is a victim of the war that is so effectively paralyzing development in Mozambique. ■

Rhoda Metcalfe is a freelance journalist based in Ottawa. She visited the IDRC-supported groundnut project in November 1987.



Photos: Gerry Toomey / IDRC

In women's hands: Demonstration of mini-dehuller at the College of Home Science in Hyderabad.

SORGHUM AS SUBSTITUTE FOOD ENTERPRISES FOR INDIAN WOMEN

In southern India's semi-arid plains, sorghum is shedding its image as a 'poor man's' food. With the aid of mechanical dehullers, this dryland grain is now being processed into quality flour, multiplying the number of products and recipes it can be used in. The Indian researchers behind this transformation of sorghum into a prestige food are also working to ensure that the profits remain in the hands of the neediest—poor women.

GERRY TOOMEY

Late one afternoon in February 1987, a tall elderly widow in an impeccable white sari arrived at the College of Home Science, in Hyderabad, India. She had come to borrow a grain-processing machine called a dehuller from Dr P. Pushpamma, then dean of the girls' college and an internationally recognized nutritionist.

Over tea in the conference room, and to the hum of whirling fans overhead, the soft-spoken visitor presented her case. As a representative of the Old Age Welfare Centre, a local home for the elderly poor, she wished once again to use the college's rugged little mini-dehuller to process a batch of sorghum grain. Unfortunately, other groups, including one that works with slum-dwellers, were also lining up to borrow Dr Pushpamma's machine. After a frank discussion and the polite nodding of heads, an arrangement was struck to share the dehuller among the various interested groups until more of the devices became available.

In this hot and dusty State of Andhra Pradesh, sorghum is known as "jowar". Traditionally, it has had a lowly status, explains Dr Pushpamma, who has led two IDRC-funded research projects on the processing and use of sorghum, millet, and legumes.

Accounting for 15 percent of cereal production in Andhra Pradesh, sorghum is still considered a coarse food, eaten mainly by the harijans (India's untouchable caste) and other agricultural workers. Much of the urban population has shifted away from sorghum consumption, preferring now to eat finer, more expensive grains

such as rice and wheat.

Neither have the small farmers helped sorghum's image. Although improved varieties of sorghum are available, small farmers usually prefer to stick to their traditional native varieties, and produce mainly for home consumption. Only about 20 percent of sorghum and millet farmers market their produce.

Although some of the local varieties yield only a fifth as much as the improved ones, farmers continue to grow them because they prefer the foliage for animal fodder and see the new varieties as requiring a larger investment in seed, fertilizers, and irrigation.

Despite its image as the ugly duckling of cereals, sorghum has some excellent qualities. Like millet, it is a drought-tolerant crop, grown throughout the semi-arid tropics, especially in India, China, and sub-Saharan Africa. Nutritionally, it is com-

parable to rice and wheat.

Some farm workers say they feel hungry only two hours after eating a rice meal, but with sorghum they feel content for three to four hours. Sorghum's sugars are released more slowly, nutritionists explain, and for this reason it has good potential as a staple in the diet of diabetics.

In India, "jowar" is eaten mainly as unleavened bread (roti), as stiff porridge (sangati), or boiled as a whole grain like rice (annam). It is not fed to children as a weaning food or even in early childhood because it is thought to be too hard to digest.

"It has always been treated as a poor man's food," says Dr Pushpamma. "The very fact that it has this low status meant that people actually avoided saying they eat sorghum."

But if the seed coats are mechanically rubbed off before the grain is ground into flour, sorghum takes on a new appeal. In



In rural India, the force of passing vehicles serves to thresh the sorghum before it is dehulled and milled.

her research, Dr Pushpamma has found that, freed of its husks by a dehuller, sorghum becomes an acceptable product in the eyes of Andhra Pradesh consumers. It is considered on a par with rice and wheat flour in terms of its versatility in cooking. It is also less expensive and, contrary to popular belief, has excellent potential as a weaning food, especially when mixed with protein-rich legumes.

With the training and encouragement of Dr Pushpamma and her staff, the woman in the white sari and her friends from the Old Age Welfare Centre have been busy baking snack foods. They use dehulled sorghum and legume flours, and sell their products to a merchant in Hyderabad, a city of 2.2 million people. The profits have helped the poorer residents of the Centre to pay their share of the home's operating costs (the 10 percent not covered by the social welfare department).

This urban food enterprise—and several similar village-based experiments—are just the beginning. Last year, the College of Home Science launched a major drive to introduce and test dehuller technology in Andhra Pradesh. Its goal is to improve nutrition and incomes, especially those of women and children, by promoting the creation of small food enterprises.

Solid demand for sorghum

The work takes the form of a third, three-year applied research project, again funded by IDRC. It is a complex, multidisciplinary effort aimed at catapulting the college's on-going research program into the technology dissemination stage.

Under the guidance of Dr V. Vimala, a nutritionist and former colleague of Dr Pushpamma, the research team has already market-tested dehulled sorghum flour and grits in two urban supermarkets and one small shop. Reply cards were included in the packets. The responses have proved a solid demand for the products.

In the coming months, this market research segment of the work will be expanded to determine sorghum and legume consumption patterns, consumers' socioeconomic status, and demand for dehullers. These studies will cover both rural and urban areas.

A second segment of the research is to evaluate dehulling equipment for three different scales of application: households, villages, and semiurban areas. Three mini-dehullers designed and built in Canada are about to be imported and tested. Two larger models, manufactured in Botswana and suitable for semi-urban applications, are also on order. (See *Reports*, October 1987, p. 4-5.)

A more important "hardware" activity, though, for the long-term success of the project is to successfully design and produce dehullers in India itself. As a first step, six mini-dehullers are now being built by a local manufacturer, the Andhra Pradesh State Agroindustries Development Corporation.

All the equipment, imported and local, will be evaluated for efficiency—for example, power consumption, labour requirements, and time needed for dehulling. The researchers will test them on several varieties of sorghum and millet, as well as on legumes such as mung beans (known locally as green gram) and pigeon peas.

The third, and perhaps most important, component of the project is to determine the technical and managerial ingredients needed to set up small sorghum and legume processing enterprises managed by women. Here, Dr Vimala has the strong support of a grass roots program with which she is already affiliated—the Development of Women and Children in Rural Areas (DWCRA) program.

Run by two levels of Indian government in cooperation with UNICEF, the DWCRA program aims to improve the well-being of women and children below the poverty line through income-producing cooperatives. Under the IDRC project, small groups of DWCRA women will be given the opportunity to set up food-production businesses.

Explains Dr Pushpamma: "Whenever a technology is developed and taken to the stage of economic activity, it is the men who get into the whole business. I think we really have to keep it (sorghum and legume processing) as a women's realm so that women will get the profits."

In order to find out how useful sorghum

and millet might be in government supplementary feeding programs for children, a large bakery will be built to produce biscuits for weaning preschool children. These will be distributed through a government-funded program called Integrated Child Development Services.

Why biscuits? "The mothers don't consider it a food if it's in powder form," says Dr Pushpamma. "They think it's medicinal and won't buy it regularly. But there's a perception that biscuits give strength to children. It is the most prestigious food they like to give their children."

Under a separate IDRC project just begun, Indian communications experts will come up with an integrated plan for popularizing the research results and changing people's eating habits.

Dr Vimala's team is proceeding on a solid base of research results obtained from the first two phases under Dr Pushpamma. In addition to providing basic data on local food preferences and diet, the earlier work pinpointed post-harvest production bottlenecks, particularly dehulling. (See box.) The recommended solution—the introduction of dehullers to add value to sorghum and other hard-to-process crops—is now being pursued in earnest.

If successful, women in Andhra Pradesh will benefit from the growing business income, children will be better fed, and sorghum will regain a niche in the Indian diet. ■

DEHULLING SORGHUM THE HARD WAY

The idea of dehulling sorghum and other grains to make them more palatable isn't new. For centuries, villagers have pounded their stored sorghum manually before consuming it.

In Andhra Pradesh, India, about 60 percent of villagers do so; the rest grind their sorghum directly into a coarse whole-grain flour.

Before dehulling by hand, the sorghum is usually moistened first to loosen the seed coats. A kilogram of grain requires about a quarter litre of water. Next it is pounded in a mortar using a long wooden pestle. This is a tedious job, usually done by women and requiring half an hour to prepare an average daily batch of 2 or 3 kilograms.

After being pounded, the dehulled grain is rubbed and winnowed, then washed a few times to remove all the seed coats. (The water and residue can be fed to livestock.) The sorghum can

then be prepared like boiled rice, or sun-dried in preparation for milling.

An assembly of two circular abrasive stones called a "chakki" is used to grind the dried sorghum into flour or meal right in the home. Alternatively, some people bring their dehulled grain to the local mill.

Manual dehulling is obviously a lot of work—work that can easily be handled by simple machines. Furthermore, according to the findings of an IDRC-supported research project, manual dehulling results in higher losses in both the quantity and nutritional value of the grain than does mechanical dehulling. The resulting amount of digestible protein, however, is similar for the two dehulling methods.

In the case of legumes, which are notoriously difficult to dehull by hand, the time saved by using a mechanical dehuller is even greater. ■

CHILE'S MEDICAL BLINDSPOT

ROBERT CHARBONNEAU

An estimated 5 percent of Chileans are physically dependent on alcohol and another 10 percent are heavy drinkers, defined as people who consume more than 80 grams of alcohol a day or get drunk more than 12 times a year. Most of them are men living in the poorer districts, although no class or sex is free of overconsumption.

Dr Ramon Florenzano and Dr Alfredo Pemjean work in the University of Chile's psychiatry department on the medical and social effects of excessive alcohol consumption. In their opinion, the one percent of course time that medical training programs devote to this subject is not enough. This has led them to undertake a joint study, with IDRC funding, to evaluate an alcoholism training program for interns in schools of medicine. Their hypothesis is that better trained interns will find it easier to diagnose problem cases and refer them to specialists.

The initial impetus came from a seminar on alcoholism held in Sao Paulo, Brazil, in 1984, at which the Chilean researchers suggested the idea of testing an improved course on alcoholism.

The research program had a number of facets: a survey of teaching programs at the National School of Medicine and 116 other medical faculties in the country; an evaluation of student knowledge; the creation of two course modules (one intensive, the other spread over two years); observation of the effects of the course on interns during their work; and the development of tools for evaluating the interns' behaviour.

What did the researchers discover? First, that the number of alcoholics who showed up in emergency rooms was much higher than expected. In the three medical centres surveyed, the number of problem drinkers varied from 52 to 85 percent of patients. In the emergency rooms of two Santiago hospitals, El Salvador and Barros Luco-Trudeau, from 50 to 77 percent of the patients had problems related to alcoholism and from 10.8 to 16.5 percent were drunk in varying degrees when they came in.

These data, of course, exaggerate the problem because they contain a built-in bias. One would normally expect that people who have consumed alcohol are more likely to become involved in family fights, violent acts, or accidents, and thus more likely to wind up in a hospital emergency department. Nonetheless, the figures are disturbing.

What is even more disturbing is that the doctors only on very few occasions identified the alcoholics. (For obvious reasons, the doctors weren't informed beforehand that their work was being observed.) Only

one or two percent of the doctors picked up on the alcoholic condition of their patients and, of those, half referred them for treatment.

These results led the researchers to set up a course for medical students. The 30 hours' worth of material was tested in two formats. First, it was presented as an intensive two-month course, with lecturers coming in to present cases or discuss the effects of alcohol. Secondly, a modular approach, with blocks distributed through the internship period, was tried at another school.

Results from both tests were rather disappointing. Despite the enthusiasm of the teaching staff, it was difficult to change attitudes. Although the courses had an initial impact, it was short-lived, gradually fading the following year.

The researchers suggest a number of reasons for this failure. To begin with, internship is probably too late a stage of training to change attitudes. Secondly, because no examination was given, the students were less likely to be motivated. Thirdly, the training period was very brief. Lastly, the interns were pessimistic when speaking about problems associated with alcohol abuse, and sometimes even expressed some sympathy for drinkers.

Only one or two percent of the doctors picked up on the alcoholic condition of their patients.

Despite the lack of success of the course, the research project allowed several other objectives to be attained. The researchers were able, for example, to test an alcoholic-identification questionnaire better adapted to Chile's needs. The EBBA test, as it is known, has only seven simple questions. It was validated on 408 male patients in three medical centres. Some of the questions in the famous American CAGE test, which is used in many countries, don't really apply to Chile where the social perception of alcohol is different.



Another American test, the TSBP, has 24 questions "which often set patients against us," says Pamela Orpinas, a psychologist who is involved in the research. "The seven questions in the EBBA test give us a reliability level of 0.79. In other words, there is a risk that 11 percent of the diagnoses will be wrong. But the test is really easy to apply and the questions are less accusing. They don't ask how much people drink..."

The research also enabled the team to field-test the effectiveness of a diagnostic tool: a strip of paper which is placed in the patient's mouth to measure his or her alcohol level on the spot. Apart from being easy to use, these little strips, made up and supplied by the Addiction Research Foundation, in Toronto, Canada, are about 85 percent effective. They are also a little more sensitive than the breathalyzer test used to detect low levels of alcohol in the blood. This makes them more practical in the context of prevention.

The researchers are hoping to exchange information on the subject of alcoholism at a meeting scheduled for October 1988. Representatives from 16 Latin American countries are expected to attend.

Alfredo Pemjean believes there are still many avenues to be explored. Alcohol is a major social problem in Chile. In 1981, it is estimated that it accounted for a loss to the economy of US\$1.62 billion—the equivalent of all the income generated by copper exports at the time.

The medical students didn't adopt the desired behaviour. They didn't refer patients with alcohol problems. Their instructors didn't seem to take much interest in the subject. "Perhaps we ought to work more intensively with the instructors than with the interns," suggests Pamela Orpinas.

As for the interns, their opinion is positive. They believe that the course boosted their motivation and improved their attitudes towards alcohol. Sixty percent of them say that it increased their understanding of alcohol and its effects. ■

MOSQUITO-BORNE DISEASES

AN INFORMATION NETWORK FOR SOUTHEAST ASIA

MARK TIMM

Developing countries, especially in Asia, have a lot to gain from fast and easy access to information about mosquito-borne diseases. In Southeast Asia, the important work of collecting, analyzing, cataloguing, storing, and disseminating such knowledge is carried out by the Museum and Reference Centre (MRC), operated by the Faculty of Tropical Medicine of Mahidol University in Bangkok, Thailand.

The MRC, in operation since 1981, consists of a scientific information facility serving researchers and other professionals dealing with mosquito-related diseases, as well as a museum open to the public.

Mahidol University's tropical medicine faculty is part of a network of tropical medicine (TROPMED) centres set up throughout Southeast Asia under the auspices of the Southeast Asian Ministers of Education Organization (SEAMEO). The Mahidol centre focuses on clinical medicine and tropical pediatrics and publishes the *Southeast Asian Journal of Tropical Medicine and Public Health*. Mahidol is also the coordinating office for the entire TROPMED network.

For the present, the MRC's efforts are focused on four mosquito-borne diseases only: malaria, filariasis, dengue haemorrhagic fever, and Japanese B encephalitis. Over the years, these diseases have been the subject of much research, so there is already a substantial pool of information on them.

The MRC's services are aimed at a variety of people—scientists, university students, even schoolchildren. The Centre acts as a clearing house for up-to-date

research information. Video and slide presentations are also given and the museum has prepared easy-to-understand exhibits, models, and charts about mosquito-borne diseases and how to avoid them.

IDRC has given support to the MRC to strengthen its information activities, including the funding of short periods of training in London, U.K., for four staff members. Two studied medical illustration and audiovisual techniques. One worked towards a Master's degree in information sciences, and one received training in taxonomy and the collecting of mosquitoes. In addition, an editor was trained under an IDRC-sponsored program in scientific publishing and editing, in the Philippines.

Four activities at the MRC serve to promote the effective management of information about mosquito-borne diseases. The first is the actual collection of information. MRC staff monitor numerous publications for relevant material. In addition, a team tours Southeast Asia each year to collect and exchange information and specimens with other scientists. The Centre's sole mosquito taxonomist has identified and processed about 10,000 specimens covering some 200 species of mosquitoes.

The second step is to computerize the collected information. Professor Santasiri Sornmani, dean of Mahidol's tropical medicine faculty and the leader of the IDRC project, stresses the importance of this activity. Not only does it make work within the MRC more efficient, it also enables the Centre to retrieve the information more quickly for scientists elsewhere in the region.

The third aspect of the project is the dis-

semination of collected information as widely and as rapidly as possible. MRC has produced dramatic videos which depict the life cycle of the mosquito, give alarming statistics about the incidence of disease, and explain prevention methods.

For scientists, MRC publishes a quarterly, *Mosquito-borne Disease Bulletin*, 1000 copies of which are distributed free throughout the region and around the world. It also produces an annual annotated bibliography of published mosquito-borne disease research.

Future plans include designing a mobile display unit which could travel to schools, health centres, and even remote rural villages.

Finally, the MRC is still planning to train TROPMED officers elsewhere in the region in information handling to ensure more effective collaboration. This is the objective of a second phase of the IDRC-supported project.

During phase one, the project staff adapted to their own needs mini/micro-computer software called CDS-ISIS, developed by the United Nations Educational, Scientific and Cultural Organization (UNESCO) for similar data management. The participants in the TROPMED mosquito-borne disease information network will now be trained to use the adapted software to abstract, index, and retrieve information. The training program will last two years and will include participants from Indonesia, Malaysia, the Philippines, and Sri Lanka.

At the conclusion of phase two, each member-country will manage its own national-level information about local mosquito-borne diseases.

The regional flow of information on mosquito-borne diseases has already begun to increase. "At the moment, researchers in this part of the world get information on mosquito-borne diseases quicker than before," Dr Santasiri says. "It also encourages them to write and publish their own work. They don't have to wait too long to have their information published."

Mark Timm is a Canadian freelance journalist who writes on Southeast Asian affairs. He is currently based in Bangkok.

Museum staff explain to visitors the kind of environment in which disease-carrying mosquitoes are easily able to breed.



Photo: Mark Timm

A working paper entitled "A List of Mosquito Species in Southeast Asia" is available from:
MRC-TROPMED
Faculty of Tropical Medicine
420/6 Rajvithi Rd.
Bangkok 10400, Thailand

LEARNING ENGLISH STEP-BY-STEP IN CHINA

GERRY TOOMEY

China's "open door policy" toward the West, introduced a decade ago, has triggered an explosive demand for English language training and "authentic" English reading and audiovisual material.

The East China Normal University (ECNU), in Shanghai, probably understands this cultural phenomenon better than any other organization in China. In an attempt to revamp language teaching methods and satisfy China's seemingly insatiable appetite for the written and spoken English word, the university's faculty of education has produced a highly successful English listening program called Step-by-Step.

The package was developed between 1983 and 1986 primarily for university English majors. It consists of 32 audio tapes, four books for students, and four books for teachers. By early 1988, 3.6 million Step-by-Step books had been distributed, and some 500 universities, colleges, and other educational institutions in China were using the system.

Photo: David Vainola



Step-by-Step was intended for university students, but its creators now hope it can be "stepped down" to high school level.

Following the Cultural Revolution, school enrollment in China increased at all levels. Reforming the educational system, including foreign language teaching, became a top priority. "Curriculum, teacher qualifications, school management, and evaluation and assessment came under critical review," explains Dr Ted Owen, a professor in the faculty of education of the University of Victoria, in British Columbia, Canada.

In the past, people thought that the BBC voice was the standard.

Since 1980, the University of Victoria has been nurturing what Dr Owen calls a "sister relationship" with the East China Normal University, one of two universities in China designated as "key" institutions in the field of education. In an attempt to enhance China's educational research capability, the two institutions launched and carried out eight joint research projects with IDRC funding. To ensure direct and meaningful cooperation, a number of students and faculty were exchanged between the two universities.

The research projects dealt with a variety of issues critical to the successful reform of the Chinese system: career education, computer-assisted learning, administrative reform, educational psychology, "active" or participatory learning (in contrast to rote learning), distance education, evaluation techniques, and English language teaching curriculum.

In recent years, China has been flooded with English information and English-speaking tourists. At the same time, new economic, cultural, and intellectual ties with other countries have been established, reinforcing the demand for English training. Although courses in languages such as Japanese, Russian, and French are available in some schools, English is the overwhelming preference of China's approximately 100 million high school students, especially those in the cities. It is also very popular among university students, who are required to take two years of foreign language training.

The fascination with English is not limited to full-time students. "There's been a great deal of self-study of English," said Prof. Zhang Min-Lun of ECNU, one of the principal architects of the Step-by-Step teaching system. There is especially high

interest among workers in the tourism and hotel industries. "In Shanghai, one out of three workers attends school in their spare time, many of them to study English."

More than half of all households in China have TVs, and programs that teach English are very popular, especially a BBC production called *Follow Me*.

Following a seminar in Toronto last March, Prof. Zhang described some of the difficulties faced by Chinese students of English in the past. Until China's open door policy took effect, a major hurdle was the lack of access to "authentic" English. Many teachers of English had themselves learned the language from textbooks with minimal exposure to English idiomatic usage or native speakers. And often the vocabulary taught was inappropriate.

Another problem was that of the "model" speaker. "In the past, people thought that the BBC voice was the standard," said Prof. Zhang. This resulted in people having difficulty understanding accents and mannerisms that strayed from the British model. "It's important to understand spoken English from a variety of people."

Step-by-Step certainly provides variety. A total of 463 different English voices—female and male, young and old, and a variety of regional accents—are used on the audio tapes, about 15 percent of them Canadian.

"Our guiding principle has been to achieve listening comprehension through substantial experience with spoken English," said Prof. Zhang. The system is based on the idea of "input first, production second". In the beginning, the students are allowed simply to listen to the English tapes without having to speak, as if they're listening to music. This helps to prevent anxiety. "The teacher should be tolerant of the students' silence."

In developing Step-by-Step, "we carefully examined about 2000 tapes containing different kinds of spoken English that were available at our sound laboratory," explained Prof. Zhang. "For more than two years we listened to and recorded daily broadcasts in English from different countries. We analyzed and made notes on cultural and linguistic points that we thought might be especially difficult for Chinese learners."

There is now a need, according to Prof. Zhang, to expand the Step-by-Step system to high school students because they are at "an optimal age—the threshold—for learning a language."

COMPUTER MATCHMAKING

LINKING PROJECTS WITH INVESTORS IN LATIN AMERICA AND THE CARIBBEAN

WILSON RUIZ

“**W**e are now entering an age in which the control of data across national borders will determine international power relations,” says economist Rommel Acevedo of the Latin American Association of Financing Institutions for Development (ALIDE), in Lima, Peru.

At present, “transborder data flows”—the term for electronic transmission of computerized information across international borders—are tapped mostly by the industrialized world. A handful of transnational corporations have a virtual monopoly on the information business which is widening the gap between the information-rich countries of the West and the information-poor countries of the Third World.

Many Latin American analysts of science and technology policy believe that this concentration of data flow is the root of underdevelopment in this age of technology. “The generation and control of data processing services and computerized data are establishing a new kind of dependence,” says Francisco Sagasti, an internationally recognized expert on science and technology policy who is based in Lima.

Yet Third World countries have been slow to take decisive action to develop their ability to collect, process, store, and use information to make vital economic and business decisions.

ALIDE, however, is implementing practical measures to bring the benefits of timely financial information—and of new information technologies—to Latin America and the Caribbean. With IDRC assistance, ALIDE has introduced a new computerized information service into its established RIALIDE regional information network. The Financial and Technological Information Service on Projects and Investments—SIFT, for short—is designed

to help the initiators of small and medium-sized development projects to identify potential investors, and vice versa.

In recent years, the economic recession has hit Latin America and the Caribbean hard. As a result of inflation, indebtedness, and low productivity, the cash needed by national development banks to finance their work has evaporated. There has thus been a pressing need for alternative and supplementary sources of development financing.

The new SIFT service fulfills the important function of providing the information needed to match those sources of financing—whether in the region or elsewhere—with investment opportunities. SIFT, which uses DBASEIII/PLUS and CD-ISIS software, serves over 60 national development banks and corporations in the region, as well as a host of international banks, investors, and businessmen.

In addition to keeping inventories of current development projects and sources of financing, SIFT makes available a variety of technical information, national financial statistics (on foreign trade and industrial production, for example), and bibliographies. Equally important, it provides information on various countries’ investment incentives, laws, and policies.

The SIFT service collects and disseminates information via 17 institutions which act as National Project Liaisons (or focal points) for an equal number of countries.

In view of the current high costs of telecommunications, SIFT’s cooperative approach is a cost-effective alternative to subscribing to computerized business information services offered by transnational corporations. “The sharing of costs and services is the only way for Latin American and Caribbean countries to gain access to the international on-line database market,” explains Mr Acevedo.

A wide range of information is already

stored in SIFT’s databases. For example, details are now available on 122 small and medium-sized national development projects in search of funding in 14 Latin American and Caribbean countries. By the end of the year, ALIDE expects to have over 200 projects plugged into the SIFT service network.

SIFT also provides information on 85 international sources of capital interested in financing development projects in the region. These include New York’s Bankers Trust, First Boston Corporation, the Toronto Dominion Bank, Bank of Montreal, the Import-Export Bank of Japan, and export development corporations in half a dozen European countries.

When a specific investment project is identified by SIFT, the computer matches up project specifications with information on sources of financing. Complementing this are market data on the materials and products that will be needed to carry out the project. All this adds up to a detailed dossier, consisting of information on the technological needs of the project, as well as statistical, economic, and legal information about the host country.

For Latin American and Caribbean national development banks and corporations, ALIDE’s SIFT database and network represent a giant step in escaping the technological dependency trap.

“ALIDE now plans to request IDRC support to share our experience with the African countries,” says Mr Acevedo. He thinks that cooperative programs with other developing countries will make possible a viable Third World network of transborder data flows to lessen the grip of transnational companies. ■

Wilson Ruiz is a Canadian freelance writer and broadcaster, based in Lima, Peru. He specializes in Latin American affairs.

In Brief

Cleaning up Ankara's air

A team of Turkish energy researchers has come up with a plan to tackle a serious problem in their capital city of Ankara: air pollution.

In January the daytime temperature in Ankara averages only 0 degrees Celsius. About 60 percent of the city's 2.3 million people are squatters living in shacks and to keep warm they use little stoves to burn Turkish lignite, a soft coal rich in pollution-causing sulfur.

It is not uncommon for the skies over the city to become heavily laden with a variety of particles from thousands of badly built chimneys. Because the city is bordered on three sides by mountains which block the wind, an unbreathable smog often hangs motionless over the city.

The problem is so acute that the government has sometimes been forced to ban the use of lignite and replace it with coal purchased abroad at a high price. This is a burden on the poor who end up paying twice as much for imported coal as for local lignite.

Lignite is popular in Turkey, meeting 68 percent of demand for domestic heat in Ankara. In 1983, almost 18 million tonnes of it were mined.

Under the auspices of the Environmental Problems Foundation of Turkey and with IDRC support, a group of 10 energy experts undertook to examine alternative solutions for Ankara. They first assessed energy consumption in each of the 30 districts of the city. Next they recommended a number of scenarios for the city based on combinations of five possible energy sources: coal-fired central heating plants, hydro-electricity or thermally generated electricity, an urban gas system, heating oil, and solar energy.

Each solution represented an attempt to redistribute the energy load in light of available resources, costs, sulfur emissions, and a performance criterion (the ratio of pollution reduction to additional cost).

A number of scenarios were then rejected because of limitations imposed by the gas distribution network or the availability of electricity.

Scenario number 14 was the big winner. It calls for a switch to gas in five of the capital's districts and the introduction of electrically heated radiators in three others. These changes could reduce sulfur dioxide emissions over the capital by 22 tonnes a day. What remains to be



Heating homes with lignite is a major cause of Ankara's pollution.

seen is whether Turkish officials will follow up on the research results.

Robert Charbonneau

An appraisal of Canadian NGOs

Bridges of Hope? Canadian Voluntary Agencies in the Third World should jar Canada's international development community—especially the nongovernmental organizations (NGOs), the focus of this new book from the North-South Institute.

"How well do they (the NGOs) measure up to their self-image?" ask co-authors Tim Brodhead and Brent Herbert-Copley. "...on the whole, encouraging" is their assessment. Several major criticisms, though, stand in the way of a fuller endorsement by the authors:

- The NGOs tend to concentrate on keeping costs low, as a measure of efficiency, rather than using resources efficiently to maximize development impact.
- There is a general neglect of staff development, project design, and project monitoring.
- While the participation of beneficiaries in the implementation of projects is impressive, their participation in the design and evaluation of projects is weak.
- Replication and "scale-up" of successful projects beyond community levels are few and far between.
- A "significant minority" of projects require long-term dependence on foreign funds "with limited possibilities for financial sustainability".

Through this book, the North-South Institute yet again proves its worth. Co-authors Brodhead (now executive director of the NGO umbrella organization, the Canadian Council for International Co-operation), and Herbert-Copley (now with IDRC's Social Sciences Division) have done a sound job of identifying issues that the NGOs will have to face in future, especially in light of the new aid strategy of the Canadian International Development Agency (CIDA), which provides much of the NGOs' funding.

The authors structured the book around 11 "articles of faith" drawn from the NGOs' description of themselves. The early chapters of *Bridges of Hope?* provide fascinating background that sets the stage for the critical wallop in the later chapters.

The authors reveal, for example, that Canada has more than 220 NGOs doing development work—either projects overseas or education work in Canada. In 1984, they raised more than \$280 million from the Canadian public and received more than \$250 million from CIDA. They accounted for 22 percent of Canadian development aid, compared with 37 percent for government-to-government assistance, 29 percent for multilateral programs, and 12 percent for other sources, including IDRC.

NGOs have an estimated 2400 full-time employees and more than 40 000 volunteers across the country. Fully 25 percent of these agencies came into existence in the 1980s (coinciding with the African crisis).

These younger organizations tend to devote a significantly larger proportion of their budgets to relief and material supplies than do the older agencies.

The authors lay out four key challenges to be met by Canadian NGOs: information, autonomy, co-ordination, and management. Each of these aspects will be affected by CIDA's new strategy, especially its policy of decentralization.

Brodhead and Herbert-Copley don't redefine the role of Canadian NGOs in development. That job belongs to the individual agencies. However, their book does pose issues and challenges that should assist nongovernmental organizations in making the creative changes required.

Bridges of Hope? (174 pages, CA\$14) was produced in collaboration with researcher Anne-Marie Lambert. It can be ordered from: The North-South Institute 55 Murray Street, Suite 200 Ottawa, Canada K1N 5M3

Hugh Nangle
Ottawa

All about India's cows

Everything you ever wanted to know about India's dairy industry can be found in the *Dairy India 1987* yearbook.

This 738-page typescript publication provides information on everything from cattle crossbreeding to the most recent packaging and marketing techniques. It also features a listing of some 7000 dairy specialists and organizations. It even provides tips on how to make good ice cream!

In recent years, the dairy industry in India has undergone rapid technological change. Today the country ranks third in the world in milk production with an annual output of about 44 million tonnes. *Dairy India 1987* provides detailed coverage of the most recent technological advances and trends in areas such as biotechnology—for example, production of dairy enzymes for the food and detergent industries.

In the area of fodder production, a new system now being tested uses hermetically sealed chambers to provide ideal growing conditions. Seeds are germinated, without soil, and within eight days, fodder plants are mature enough for harvesting. The entire plant, including roots, is used. A single Fodder Production Unit, as it is known, can produce one tonne of green fodder a day.

New Releases

According to an article in the yearbook, tests results indicate that the system dramatically lowers feed costs and increases milk production.

Indian researchers are also experimenting with improved packaging better suited to its hot climate. A new aseptic packaging material extends the shelf life of dairy products from several hours to over 90 days without refrigeration. A number of layers help to prevent spoilage by keeping oxygen from penetrating to the contents of the package. The new materials promise to give a new thrust to the marketing of a variety of dairy products.

The yearbook is available for US\$70 (plus postage and handling) from:

Dairy India Yearbook
A-26 Priyadarshini Vihar
Delhi 110092, India

Choosing the right computer equipment

The Centre for Development of Instructional Technology (CENDIT), in New Delhi, has produced a 125-page manual to help small research and information institutions select the computer equipment best suited to their needs.

India's computer industry, both domestic and foreign firms, is booming. A wide variety of computer products is now available, posing some tough choices for buyers. In the case of documentation centres, libraries, and small research centres—institutions which stand to benefit greatly from computerization—computer equipment represents a large investment and therefore the options must be weighed with great care.

About 15 Indian organizations—from Delhi, Bombay, Hyderabad, Pune, and Jajpur—contributed to the manual by answering a questionnaire on their needs and by describing their current state of automation and medium-term goals. Funding for the development of the manual was provided by IDRC.

The survey revealed that until now Indian libraries have resisted going on a computer-buying spree. It also showed that what libraries would like to computerize first is their cataloguing and acquisitions operations. As for documentation centres, they are more interested in introducing word processing and setting up data bases.

The questionnaires enabled CENDIT to include in the manual a

number of model computer configurations geared to these kinds of institutions.

The manual contains about 20 information sheets for the prospective computer equipment buyer to fill out. These help to determine the institution's computer needs and the optimum equipment configuration. Thus, the institution has all the information it needs to prepare a call for tenders. A comparison chart allows the institution to evaluate the resulting bids using a point system.

The manual, which attempts to demystify computer terminology, also includes two case studies and lists the addresses of computer manufacturers (which might also be of interest to institutions in countries bordering India).

For more information on sales and distribution of the manual, write to:
CENDIT
D-1, Soami Nagar
New Delhi
India

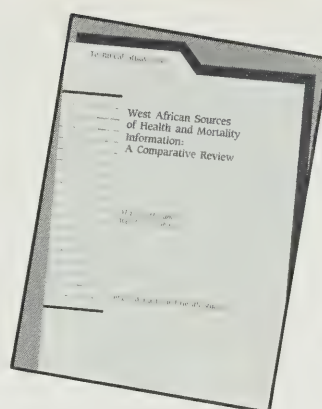
Robert Charbonneau

The Ontario connection

Ontario, Canada's most populous province, has a well trained pool of scientists working in a range of disciplines pertinent to the needs of developing countries. In 1985, IDRC and the University of Waterloo in Ontario held a conference to examine the prospects for collaboration between these researchers and their Third World counterparts.

Research, Resources, and the Environment in Third World Development, edited by J.G. Nelson and K. Drew Knight and published by the University of Waterloo's department of geography, reports on part of that conference. It is a collection of four background papers and 10 brief contributions on issues related to natural resources and the environment. Topics range from policy and theoretical issues such as priorities, training, communications, and ethics in research, to specific case studies of research collaboration in areas such as geology, agrogeology, aquaculture, water management, and remote sensing. The book also includes a list of the 44 participants in the resources and environment workshop.

The book is available for CA\$18.95 from:
University of Waterloo
Dept. of Geography Publication Series
Waterloo, Ontario
Canada N2L 3G1



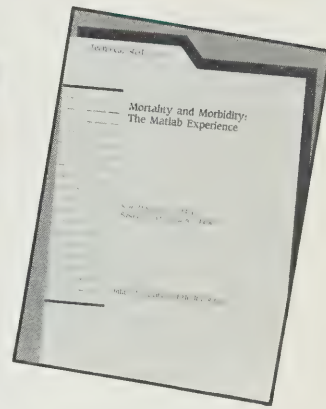
West African Sources of Health and Mortality Information: A Comparative Review

Allan G. Hill and Wendy J. Graham,
IDRC-TS58e, 61 pp.

The past decade has seen a steady increase in the demand for information on health and mortality trends in developing countries. Industrialized countries' information systems, which include full birth and death registration, often linked via sophisticated methods to other sources such as the population census, are clearly inappropriate for most developing countries. Although special surveys do provide valuable information on health and morbidity, they are relatively expensive to conduct and analyze and may not be the most appropriate tool for measuring the effects of a specific health program on mortality or morbidity.

In this book, different sources of information are reviewed for four West African countries. The survey shows that much potentially valuable information is being collected, much less of it analyzed. There are often severe problems of interpretation because of biases in the data routinely collected from health services.

The authors conclude that further development of techniques for collecting and analyzing data routinely produced by health services is probably a more productive route to follow than attempting to install the expensive registration systems used in industrialized countries.



Mortality and Morbidity: The Matlab Experience

Stan D'Souza, A. Bhuiya, Susan Zimicki, and K. Sheikh,
IDRC-TS56e, 59 pp.

The Matlab field station in Bangladesh has acquired international recognition because of the availability of longitudinal demographic data of reliable quality since its inception in 1966.

This paper is intended to present examples of how mortality and morbidity can be studied within a small area. Recent efforts to ensure timely processing and linkage of data, through the use of an appropriate numbering system and new approaches in data base technology, are discussed. The possibility of grafting small studies at relatively low cost onto an ongoing longitudinal system is described. The paper attempts to establish that although cost considerations prevent population laboratories like that of Matlab being replicated in every developing country, regional centres, particularly in Africa, might be useful.

Le sucre Menace ou défi ?

IDRC-244f

Évaluation de l'incidence du
développement technologique
dans les industries des
produits sucrés et du sirop
de glucose à haute teneur
en fructose

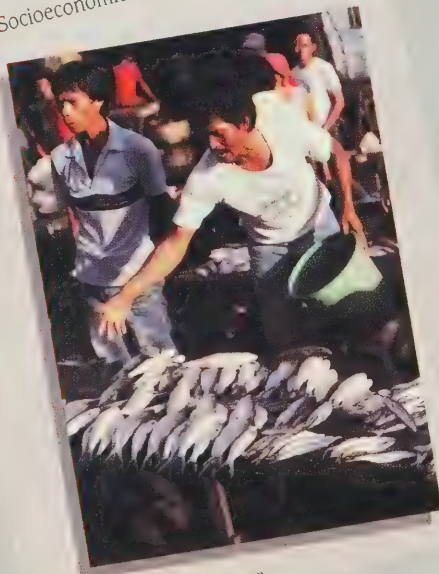
Clive Y. Thomas



Metodología de Investigación en Sistemas de Cultivo en finca



Small-Scale Fisheries in Asia: Socioeconomic Analysis and Policy



Editor: Theodore Panayotou

In addition to *Reports* magazine, IDRC also publishes scientific monographs, technical reports, and general interest materials on the role of research in international development. A catalogue of current publications is available from the nearest IDRC office (see page 3 for complete addresses).

Publications may be ordered from the following IDRC sales agents:

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THE
IDRC

reports



Victims of environment

Catching fog p. 16

Letters

Rugged Philippine pump not mentioned

When the January 1988 issue of *IDRC Reports* arrived, I read the article on pumps in the Philippines, "Water for the barrios". I was surprised that the authors of the article completely ignored the substantial work on pumps and water management conducted by the Water Resources Center of the University of San Carlos in Cebu City, Philippines.

The projects of the Water Resources Center seem to have been much wider in both scale and scope than the project described in the *Reports* article. The pumps used are 100 percent locally made and have a much better survival rate than the ones described in the *Reports* article. For details, I refer to the project reports: *Rural Water Supply: Final Report of a Four Year Project*, Volumes 1, 2, and 3, published by The Asia Foundation and the University of San Carlos Water Resources Center, in 1986.

I have been a diligent *IDRC Reports* reader for many years. Colleagues have borrowed old issues to be used as material for teaching English (science) reading comprehension in our Master's program in development studies.

Ed van den Berg, PhD
Science Teacher Training
Programme

Satya Wacana Christian University
Salatiga, Indonesia

Upper Amazon people need immunization too

I read with interest your report on the Canadian International Immunization Program that is working with WHO to achieve universal immunization by 1990 (*Reports*, April 1988, p. 26). Although I recognize that Canadian efforts are being focused in Commonwealth and Francophone countries, I must ask who is in charge of dispensing these vaccines in Peru? As a Canadian studying medical plants of the Jivaro people in the Upper Amazon, I have become particularly sensitive to the lack of coordinated effort to protect the aboriginal populations in our study area. I am especially concerned about the lack of a realistic plan to help those with tuberculosis and prevent it from spreading to others.

Although skin tests have shown that some villages are more affected than others, no follow-through has been devised that will ensure effective treatment and immunization. To see an 18-year-old girl die for lack of treatment continues to sadden and frustrate me.

Aside from those vaccines already mentioned in your report, may I also suggest that hepatitis B and measles be added to your list of "killer diseases" when considering the Amazon region of Peru. We have witnessed a particularly devastating outbreak of delta-hepatitis B on the Rio Tigre, and with the cost of the vaccine it was only available to personnel on the military base. Moreover, the number of herbal cures to ameliorate the symptoms of measles suggests a concern for this infection as well. Also, in April of 1987, because of fiscal constraints, yellow fever vaccine was unavailable in Lima to all who needed it.

Here are a couple of "field suggestions" regarding these activities.

Solar energy is becoming a reality and hopefully some day solar cells could be installed permanently in many large villages. They would not only help maintain the "cold chain" essential to preserve heat-sensitive vaccines, but also provide energy for radios to help elicit medical aid.

The re-use of needles without adequate sterilization is without a doubt a significant means of spreading both hepatitis and AIDS. In certain Third World countries this problem is compounded by the inherent belief that parenteral medication (injections) is still the best method of treatment, and the use of oral antibiotics is usually met with skepticism. However, when this mode of application is required and the use of disposable needles is not possible, clearly sterilization by the use of kitchen pressure cookers should be promoted as a practical and more reliable method than boiling.

I shall be returning to South America in mid-June to continue my studies among the Jivaro people of Peru and Ecuador. If there is any way I can help the Canadian International Immunization Program (CIIP) to achieve the goal of universal immunization by 1990, please do not hesitate to ask.

Memory Elvin-Lewis, PhD
Professor of Microbiology
Washington University Medical
Center
St. Louis, Missouri
U.S.A.

Editor's Note: We have forwarded Dr Elvin-Lewis's letter to CIIP. Dr Ciro DeQuadros of the Pan American Health Organization in Washington informs us that the Ministry of Health distributes these vaccines in Peru. However, he notes that the Peruvian program is not that effective, saying last year under 40 percent of all children under one year of age were vaccinated. In an effort to improve health, the ministry is holding a national vaccination day twice yearly.

Repository of symbols and images

It's encouraging to see the support and recognition being given to crafts and craftsmanship by IDRC and CIDA (*Reports*, April 1988).

The potential for crafts in local development has not yet been recognized in Canada. In 1988, the Nova Scotia Department of Tourism and Culture and the Nova Scotia Designer Crafts Council released the first provincial study of Production Crafts in Canada. It showed that 287 craft businesses produced \$10.4 million in sales and employed 3720 full-time or significantly part-time workers. The government funds invested in crafts were more than repaid by sales tax.

The report noted that crafts are an excellent employment and income generator relative to investment; are rooted in traditional occupations while offering a bridge into high-tech processes; represent "decentralized factories" in both urban and rural areas; have increased the income of women; and enhance the province by emphasizing quality and distinctiveness.

The value of the crafts sector goes beyond mere material considerations. In my 1986 book on crafts, *Head, Heart and Hands* (published by Braemar Publishing, 5680 Inglis St., Halifax, N.S. B3H 1K3), I explored the history of crafts in this province. Crafts are the repository of symbols and images that give individuals and their community identity and integrity. And crafts have flourished in Nova Scotia through a unique combination of self-help, mutual aid, community and organizational development, and partnership.

Far from being a backward sector of the economy, crafts represent a way into the future in local and regional development.

Jim Lotz
Halifax, Canada

Your feedback is appreciated

Reports welcomes letters of comment and information from readers. If you're engaged in development work similar to the projects described in the magazine, let us know — other readers may be interested. Or, if you wish to take issue with an article or clarify certain points, drop us a line. Letters should not exceed 250 words and are normally edited.

Write to:

The Editors
IDRC Reports
P.O. Box 8500
Ottawa, Canada
K1G 3H9

Young girl in northeast Thailand.
New rainwater collection tanks in
her village make for a healthier en-
vironment in which to grow up.

Photo: Donald Sharp — IDRC



Reports

THE IDRC

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The International Development Research Centre is a public corporation created by the Parliament of Canada in 1970 to support research designed to adapt science and technology to the needs of developing countries. The Centre's activity is concentrated in five sectors: agriculture, food, and nutrition sciences; health sciences; information sciences; social sciences; and communications. IDRC is financed solely by the Parliament of Canada; its policies, however, are set by an international Board of Governors. The Centre's headquarters are located at 250 Albert Street, Ottawa, Canada (P.O. Box 8500, Ottawa, Canada K1G 3H9). Regional offices are located in East Africa (P.O. Box 62084, Nairobi, Kenya); West Africa (B.P. 11007, C.D. Annexe, Dakar, Sénégal); Asia (Tanglin P.O. Box 101, Singapore 9124, Republic of Singapore); South Asia (11 Jorbagh, New Delhi 110003, India); Latin America (Apartado Aéreo 53016, Bogota D.E., Colombia); and the Middle East (P.O. Box 14, Orman, Giza, Cairo, Egypt).

The IDRC Reports

The IDRC Reports and its companion editions in French and Spanish — *Le CRDI Explore* and *El CIID Informa* — are published quarterly by the International Development Research Centre. Their aim is to keep readers informed of the activities of IDRC and to present articles on subjects related to the Centre's fields of interest. An Arabic version *بحوث للتندية* is published annually. Copies are available on request from the Communications Division, IDRC. *Editor-in-Chief:* Jean-Marc Fleury. *Associate Editors:* Gerry Toomey (English edition), Robert Charbonneau (French edition). *Spanish edition:* Stella de Feferbaum.

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CONTENTS

Letters

2

OUR THEME THIS ISSUE: CHILD HEALTH AND THE ENVIRONMENT

Poverty's children

4

Sanitary practices and traditional beliefs are linked to childhood diseases in a Latin American shantytown. *By Wilson Ruiz.*

"The trouble with girls..."

6

Child mortality rates in the Punjab tell a story of discrimination against girls. *By Robert Charbonneau.*

Juma to the rescue

7

Comics and contests are teaching health to Kenyan kids. *By Ania Wasilewski.*

Health and environment: India's inseparable duo

8

A study shows a sanitary environment is crucial to good health. *By Robert Charbonneau.*

Starting life with tetracycline

10

Preventive medicine is proving successful in saving the sight of Kenyan newborns. *By Robert Harris.*

Curse of the blackfly

11

Detailed information on river blindness in Sierra Leone will help in the creation of a control program. *By Gerry Toomey.*

Extracting profits with a shea butter press

14

A new shea butter press in Mali saves time, money, and valuable fuelwood. *By Denis Marchand.*

Every cloud has a silver lining

16

In Chile when the fog rolls in, so does the drinking water. *By Danilo Anton.*

Protecting the garden

18

Hedges make practical, inexpensive "living fences" in Burkina Faso. *By Hamado Ouangraoua.*

Pine trees and leather

20

A scarcity of natural plant tannin leads Chilean researchers to the pine tree. *By Robert Charbonneau.*

Malian researchers on innovation

22

Listening to farmers is the key to realizing their needs. *By Denis Marchand.*

Coping with the greenhouse effect

24

Scientists say we need to predict and prepare for agriculture's greatest challenge. *By John Eberlee.*

Briefs

25

News and trends in international development

New releases from IDRC

27

POVERTY'S CHILDREN

UNDERSTANDING DISEASE IN A PERUVIAN SHANTYTOWN

Photo: Luis Peirano



built medical post, Dr Carlos Bardalez has already examined over a dozen children and a crowd of mothers, many holding babies on their laps, are waiting their turn. "Diarrheal and respiratory infections are very common among children in the area," says Dr Bardalez. "If they ate better food and had some basic services like running water and sewage, these diseases could be beaten."

Dr Bardalez has just participated in an IDRC-supported study which examined the social, economic, and cultural factors associated with acute diarrhea, acute respiratory illness, and malnutrition among children under age two in the shantytown of Villa El Salvador.

Although the final report is not in yet, preliminary results show that acute diarrhea is linked, in order of importance, to: people's habits of garbage and human waste disposal, the effectiveness of public sanitation services (especially garbage collection), personal hygiene, and mothers' traditional beliefs and values.

The overall study is being carried out by a multidisciplinary team of social scientists and medical investigators from the Andean Institute for Population and Development Studies (INANDEP), a Lima-based non-profit organization that conducts research on population problems.

The project began in July 1986 with a census of one-third of Villa El Salvador's housing blocks, or about 8000 households. The goal was to register households with children under 18 months of age and pregnant women.

From the census results, the research team randomly selected one child per household, for a total sample of 530 young children. These were divided into two survey groups, or "cohorts", of 265 children each — one for each of two epidemiological monitoring surveys that formed the backbone of the research project. (Epidemiology is the branch of medical science dealing with the incidence, distribution, and control of disease in a population.)

Each of the two cohorts was further divided into four sub-cohorts by the children's ages: 0-7 days, 5-6 months, 11-12 months, and 17-18 months.

"We visited the selected families twice a week during a period of six months," says Marcela Rubio, a trained nursing assistant who lives in Villa El Salvador. She and five other equally qualified residents

WILSON RUIZ

It's 8 o'clock in the morning and the unpaved streets of District 6 in the shantytown of Villa El Salvador on the outskirts of Lima are teeming with people. Women and children come out of ramshackle huts carrying every imaginable type of container. Quickly, they make their way to the parked water truck which comes to the district only twice a week.

"We have to pay 15 intis (20 cents Canadian) for 30 gallons (136 litres) of water," explains Guillermina Tuapan, a thin woman who has already filled up two

large plastic buckets. Her two small children, Carlos, 7, and Irene, 5, stand quietly behind her waiting to fill a ceramic pot which hangs from a string.

As in hundreds of other shantytowns around Lima, water here is a precious commodity. And around the water truck one can hear story after story of disease related to lack of water, diseases that strike mainly children. "If we do not have enough water to wash the dishes and the food before we eat, the kids get diarrhea and babies sometimes die of colic," says Ms Tuapan.

Two blocks away, at the community-

Left, women line up in front of a soup kitchen in Villa El Salvador. Right, Dr Bardalez examines a child at the clinic.



Photo: Wilson Ruiz

of the shantytown weighed and measured all the children. Based on this information, Dr Bardalez and Dr Carlos Monge, the two project physicians, estimated acute and chronic malnutrition, stunting, and wasting.

Periodically, during the six months of the epidemiological surveys, the project physicians also visited the selected households where they examined the children to diagnose acute diarrheal disease (ADD) and acute respiratory infection (ARI). They also measured dehydration by checking factors such as the children's temperature, pulse, heartbeat, texture of the eyes and skin, and breathing pattern.

"This part of the study was intended to gauge and monitor both the nutritional status and the incidence and intensity of ADD and ARI," says Dr Bardalez.

While the medical investigators concentrated on the health aspects of the research, the social scientists on the INANDEP team focused on the socioeconomic factors influencing the incidence and intensity of acute diarrhea and respiratory infections. In the past, health research on the principal childhood diseases among Latin America's urban poor suffered from an incomplete understanding of the socioeconomic characteristics and cultural practices of shantytown residents.

Innovative and willing to change

Villa El Salvador was selected for the study because its inhabitants live under conditions similar to those for the large and growing number of peripheral urban dwellers in Latin America and other areas of the developing world. Moreover, the people here have demonstrated a spirit of innovation and seem willing to change their behaviour, including practices relating to child health.

Located just 15 kilometres from Lima's main square, Villa El Salvador is one of the largest shantytowns in Latin America. In 1970, this area was a wasteland; today more than 250 000 people call Villa El Salvador home. Most residents are recent migrants from Peru's highlands, in search of a better life. In fact, most are unemployed or underemployed, and few families have a regular source of income.

Villa El Salvador is awash with stories of irregular employment and long periods of joblessness brought on by frequent illness, bad luck, or the simple coldness of an

economy whose international competitiveness depends on its ability to pay low wages and ignore employee benefits.

Housing conditions in District 6, where the study was undertaken, are precarious. At first sight, it is not quite clear whether the structures are being built or torn down. Huts made of woven straw mats and split bamboo cling to the barren Andean foothills like wild mushrooms.

In this squatter settlement malnutrition is rampant and the infant mortality rate is very high: 105 per thousand. This is nearly double the rate in the Department of Lima. According to UNICEF records, 44 percent of all children under five years of age suffer from malnutrition and 55 percent of those who die are victims of acute diarrheal diseases and acute respiratory infections. In this context, INANDEP's multidisciplinary research team understandably placed great emphasis on investigating the strong inverse relationship between socioeconomic status and early childhood mortality.

Mobile units of social scientists carried out a socioeconomic survey of the mothers of all children selected for the epidemiological follow-up observations. The interviews were conducted by female social science students, many of whom had previous field research experience. The questionnaires covered basic information such as the age, sex, kinship, occupation, and level of education of household members, as well as factors such as household routines, sources of income, and access to services.

The interviewers paid particular attention to everyday habits and beliefs such as those related to infant hygiene, the causes of malnutrition and infectious diseases, medical care, breastfeeding, and the preparation of children's meals. "The stress on household practices concerning feeding, hygiene, and illness control represents a sophistication of previous methodological approaches," says Dr Bardalez.

The socioeconomic survey was based on the hypothesis that economic and social conditions, as well as cultural factors such as mothers' knowledge and beliefs about child care and health, all affect child nutrition and the incidence and intensity of ADD and ARI.

The research team also conducted in-depth anthropological case studies of 20 households. Families seen to have either a very light or very heavy incidence of

child sickness (morbidity) were selected for this purpose. The anthropologists investigated feeding practices, hygiene, and illness control habits, and how these interact with malnutrition and infant morbidity.

Overall, the study identified an urgent need to promote environmental sanitation by changing habits of the residents of Villa El Salvador and by improving sanitation services. Fortunately, it also revealed a strong potential in the population for self-help — a potential which could be harnessed through the provision of incentives and information.

Solid trust and confidence

According to both the social and medical scientists who participated in the study, the success of the project is due mainly to the solid trust and confidence that the researchers established with the residents of Villa El Salvador. During a visit to some of the households, the mothers expressed their gratitude to the doctors, nurses and social science students who periodically came to see them. "We know they want to help us live better," said a haggard woman while breastfeeding her three-month-old baby. Her drab clothes and sallowness made her look 40 though she is only 27.

The data collected by the INANDEP team are now being fed into a computer for analysis. In the coming months, INANDEP will formulate a simple and culturally appropriate way to monitor acute diarrheal disease and acute respiratory infection among shantytown children under age two. The users of this methodology will be the Peruvian Ministry of Health and other governmental and non-governmental agencies that design and deliver social and health programs among the estimated 3 million people living in squatter settlements around Lima.

The residents of District 6 in Villa El Salvador admit that the scientific results of the study are difficult to comprehend. But their participation has given them hope for the future. With the assistance of Dr Carlos Bardalez, who three days a week volunteers his services at the community medical post, District 6 plans to launch a strong campaign to improve sanitary services and infant hygiene. ■

Wilson Ruiz is a Canadian freelance writer specializing in Latin American affairs.

'THE TROUBLE WITH GIRLS...'

SEXUAL DISCRIMINATION IN THE PUNJAB

Two-year-old twins. Left, a sickly girl; right, a healthier boy.

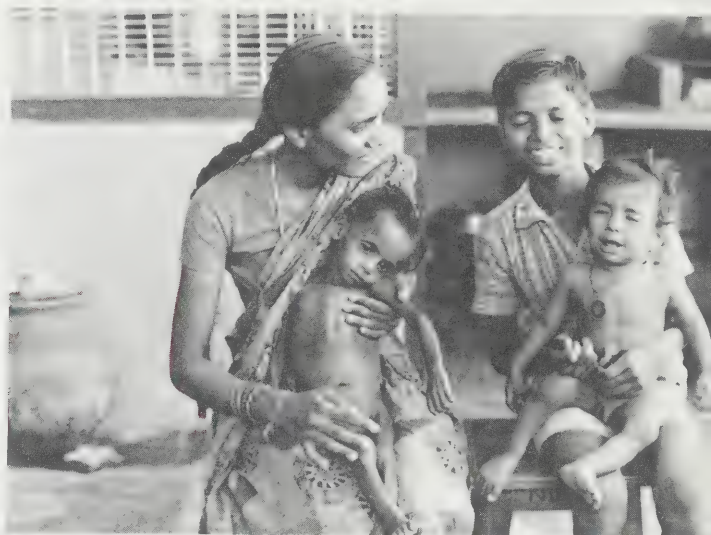


Photo: John Balcomb — Unicef

ROBERT CHARBONNEAU

“One or two boys — but only half a girl!” This could very well have been the joking reply of an Indian woman in her early twenties to the question: “How many children would you like to have?” In fact, it is the “statistical” reply given to anthropologist Monica Das Gupta during a study on the problem of sexual discrimination against children in rural Punjab, in India.

The study, conducted in 1984 by the National Applied Economic Research Council with the financial assistance of IDRC, demonstrated that the death rate among young girls was much higher than among young boys. In fact, between the ages of one month and two years, the mortality rate for girls was almost double that for boys.

The Punjab is one of the richest areas of India. It has profited greatly from the Green Revolution in agriculture. Living conditions have improved, resulting in increased revenues and the establishment of adequate health infrastructures. The birth-rate decreased from 35 per 1000 in 1971 to 30 per 1000 in 1984. But above all, infant mortality fell dramatically. It was assessed at 129 per thousand in 1972, but only 66 per thousand in 1984. As was the case 20 years ago, however, more young

girls die than their brothers. In fact, until the age of five, mortality rates for girls are consistently higher than for boys.

Ms Das Gupta, who carried out the study, wondered why. Are mothers knowingly more negligent in the treatment of their daughters, and if so, why? Does India's patriarchal society play a part in this difference?

“We have known for a long time,” says Ms Das Gupta, “that families favour sons, and that sex-based discrimination is particularly open in the Punjab. But we wanted to explore further and to understand the specific cultural, social, and economic reasons behind families' apparent neglect of little girls.

“We set about exploring various avenues,” she continues. “First, we analyzed infant mortality in terms of birth order. We found that the infant mortality rate for first children is the same for boys as for girls. On the other hand, when the family already has a daughter, the mortality rate for girls is 53 percent higher than for boys. The younger the mother, the greater this differential. The mortality rate for girls born to young mothers is 71 percent higher than for boys. This clearly demonstrates that discrimination against girls is a conscious phenomenon.”

These discrepancies appear to hold true for all income levels. However, Ms Das

Gupta noted from the study that educational level influences the mortality rate for girls. The more educated the mother, the more daughters are neglected and die.

Ms Das Gupta explains these differences in terms of the rapid social changes taking place in India. Fertility has declined rapidly, and contraception is more accessible, but the number of sons and daughters women want has not changed. They always want at most two sons and at least one. “Most women now know they will not be having more than three children,” explains Ms Das Gupta.

Accordingly, it seems that women take better care of their sons than their daughters. During the newborn's crucial first year of life, women spend 2.3 times more money on their sons than on their daughters. This means that boys are better nourished (more fat and protein), better dressed (warm clothing when nights are cool), and better cared for when they are ill. The differences are less marked after the first year, but this first year is extremely important for the child's physical well-being.

Ms Das Gupta concludes: “Women are marginalized in Indian society. They are considered less valuable than men, because they are not as frequently employed outside the home as men. Therefore, having a boy becomes a priority for couples.” ■

JUMA TO THE RESCUE

HEALTH EDUCATION FOR EAST AFRICAN CHILDREN

ANIA WASILEWSKI

Juma awoke one morning and looked for his baby sister to see how she was feeling. Kadogo, who was only one and a half years old, had been very sick with diarrhea for the past day. Juma's mother knew all about the special drink and had stayed awake to give it to Kadogo many times during the night."

This is the opening paragraph from a Kenyan children's health learning package called *The Mazingira Magazine* which tries to teach Kenyan and Ugandan children that "good health is everyone's right". The annual publication is an innovative approach to health education. It contains stories and comic strips about oral rehydration therapy (a treatment against dehydration caused by diarrhea), water treatment, safe latrines, and rainwater catchment. Educational board games that can be played with stones or pebbles, and contests that enable researchers to find out how much children have actually learned from the magazine are also included.

In this fictitious story, Juma's aunt arrives at the house and tells him they must not feed Kadogo anything until the diarrhea stops. Juma replies, "Oh no! I learned in school that we must give those with diarrhea something to eat so that they can become well and stay strong." Auntie is skeptical but she "could feel how much Juma believed in what he was saying and she was very proud that Juma had the chance to go to school and learn new things."

Juma then prepares an uji (finely ground maize) porridge for Kadogo. He tells his aunt that "Giving Kadogo food will not stop the diarrhea but if she eats a little bit many times during the day, then some of the nutrients will remain in her and make her feel better." He also continues to give her the "special drink" — Oral Rehydration Solution. That evening Kadogo is much better and by the next week she is healthy again. "She had not lost any weight so she was active and ready to play with Juma again."

In Kenya, health education is not part of the school curriculum. And yet Kenyan children are "living these issues" — diarrheal diseases, unsafe drinking water — according to Shaheen Kassim-Lakha, a member of the editorial team of *Mazingira* Institute, the Nairobi-based non-governmental organization that publishes the magazine.

The mortality rate for young Kenyan children is high: for every 1000 live births, 121 children die before age 5. Waterborne diarrheal diseases are responsible for many of these deaths. Only 28 percent of Kenya's population has access to safe drinking water, and 55 percent of Kenya's rural population lives below the absolute poverty level. In such an environment, basic health education — for example, learning the importance of clean drinking water — is crucial if children are to survive.

When the *Mazingira* learning package was launched in 1979, it concentrated on environmental issues. In 1983, however, its focus was switched to health issues. Each of the 12 700 primary schools in Kenya (and some in the Kampala district of Uganda) receives 10 copies of the 16-page colour magazine once a year. This of course isn't enough for students to have their own personal copy, but *Mazingira* can't afford to print more.

"We recommend that teachers pin it up, and put it in the library — and, more importantly, use it as class material," says Ms Kassim-Lakha.

Rather than simply writing what they think is suitable for a young readership, the editorial team asks the children to answer certain questions printed in the contest section of the magazine. For example: "Where does your family fetch water from? What was a common cure for diarrhea in the old days?" The children mail their answers to the editors and the top 40 receive prizes such as gift tokens that can be exchanged for books. The children's answers "give us insights into what the children are thinking," says Ms Kassim-Lakha. From these responses the editors plan the next issue.

Before the magazine is distributed, it is pretested in both an urban and a rural school for comprehension. The contest is also pretested "to make sure it's doable and not too time-consuming," says Ms Kassim-Lakha.

In 1986, IDRC funded an evaluation of the impact of the magazine on children's health-related behaviour and attitudes, using the contest as a survey mechanism. Over 2500 schoolchildren in upper primary school (standards 5, 6 and 7) sent replies. Students and head teachers in both rural and urban schools were also interviewed.

The researchers found there was a definite difference in knowledge between the control group (which had received copies of an earlier issue on environment) and the experimental group (which received the issue on water and sanitation). However, the survey did not provide a clear indication as to whether exposure to the magazine also elicited improved health behaviour in the experimental group.

"It's very difficult for children to make behavioural changes in the home," says Ms Kassim-Lakha. "We're not disappointed. These are tomorrow's parents and hopefully the behavioural changes will be introduced then." The students in standards 5 to 7 are between 12 and 15 years old. According to Ms Kassim-Lakha: "It will only be two to four years before these girls become parents."

Ania Wasilewski is a writer/editor in IDRC's Human Resources Division.



INDIA'S INSEPARABLE DUO

HEALTH AND ENVIRONMENT



Photos: R. Charbonneau — IDRC

ROBERT CHARBONNEAU

The narrow path climbs the hill between houses built of dried mud, planks, plastic, and tiles. The midday heat is suffocating and there are no trees to provide shade. Women crouch in front of their houses, washing dishes in basins with water from the canal that runs through the squatter settlement. Children playing among the

low-roofed houses near the ditches quench their thirst from this same source.

Pune, with a population of 1.6 million, is situated on India's Deccan Plateau 100 kilometres from Bombay. Its 327 such squatter districts are home to one third of the city's residents.

Some of these poor areas have running water, services, and electricity. Others, like Pannmela, are less attractive. Crammed

together, 276 families share four water taps and a few latrines which have long been unhygienic.

Most of the families here were driven out of their villages by drought in the early 1970s. Settling in the city was supposed to be temporary, a time to take advantage of emergency aid that didn't seem to be getting through to the rural areas. But 10 years later, the families are still here.

Ms Meera Bapat, a sociologist and researcher from Pune, has conducted studies on the migrants who have settled in Pune. "They don't move around much.

Environment has a much greater impact than maternal education level, breast feeding or family income.

I have conducted two research projects at two-year intervals, involving 3000 individuals, and I have only lost 2 percent of my sample: 60 people.

"For this study, I have chosen seven

shantytowns that are similar in terms of their location, growth rate, date of origin, and socioeconomic composition. I wanted to see what effect the immediate environment could have on the health of their populations in general and on childhood mortality in particular.

"The Pune shantytowns do not all have the same effect on their residents' health. We wanted to assess the services available and see how hygiene levels could influence health."

Ms Bapat and her team therefore developed an environmental quality index based on an inventory of potable water sources, the presence of latrines, an assessment of rainwater runoff, and a test to detect microorganisms in water and food samples. The index also relied on interviews to identify the incidence of illnesses in the previous two weeks. The circumference of children's arms was also measured to ascertain nutritional status.

The study indicated that a sanitary environment, and in particular the presence of a potable water source, had a strong influence on children's health. In fact, environment has a much greater impact than maternal education level, breast feeding or family income. "We don't have time to wait for education," says Ms Bapat. "We must improve the basic infrastructures."

In Pannela, a shantytown with nearly 4000 inhabitants, 276 households were surveyed. The results indicate that 61 percent of children under six years of age had suffered various illnesses over the past two weeks, and half the children aged one to six were malnourished. Pannela has four taps and no working latrines. Nearly 80 percent of the water and food sampled was contaminated, primarily with fecal matter.

At the other end of the city, north of the Mula River, lies the Ganeshagar district, which is also being studied. Here, the residents are primarily employed in small industry. They are able to join political organizations and make themselves heard at city hall. The local municipal representative has arranged for some environmental improvements: major roads paved, a rainwater runoff system, latrines (one per 125 residents), and taps (one for every 286 residents). In such an environment, only 44 percent of the food and water samples were contaminated, which is a clear improvement.

"Even if the residents of Ganeshagar earn more than their neighbours in



Water from the canal is used for washing clothes and bathing but also for cooking and drinking.

Pannela, their higher incomes would not prevent them from becoming ill in Pannela," adds the researcher.

The index was able to show the large extent to which the immediate environment can harm children's health. The coefficient of correlation between children's malnutrition and the environmental index is only 5 percent, for example. However, when children who are both malnourished and suffering from illness are assessed, the coefficient climbs to 65 percent, demonstrating beyond the shadow of a doubt that the environment is the primary culprit lurking behind the high infant mortality rates.

Ms Bapat stresses that dietary supplements are not enough to guarantee children's survival — the environment must also be considered. Among other things, the study has shown that variations in environmental quality and infant mortality rates are closely related and observable on very small scales: district, street, or even household. So, health and young children's survival are seriously affected. What is required is the basic political will to invest in and create a healthy environment. ■



Pannela has only four water taps and a few filthy latrines for 276 families.

STARTING LIFE WITH TETRACYCLINE

Newborns can contract a serious eye disease if their mothers are infected with gonorrhea or chlamydia. A study by Kenyan and Canadian researchers shows that administering the antibiotic tetracycline to the babies can prevent the disease.

ROBERT HARRIS

“**A**santi sana (thank you),” whispers the woman in Swahili, her expert ears tuned to the sound of new coins meeting old. Her benefactor stoops in front of her for a split second, his eyes meeting her sightless stare. He shakes his head and disappears into the crowd.

Scenes like this are repeated every day on the streets of Nairobi, begging being the last vestige of hope for many of Kenya's disabled. Such people are the victims of onchocerciasis (river blindness), polio, and leprosy — diseases that have lost their foothold in the West, but are still major problems in the developing world. Combating these ailments is not just a question of technology, but also of economics. Due to the high cost of drugs and hospital services, medical research in Africa must centre on studies that are practical, beneficial to the ordinary citizen, and cost effective.

Ophthalmia neonatorum is an eye infection that strikes babies during the first month of life. The disease is usually caused by an infection present in the mother's genital tract, which is then passed along to the child. The sexually transmitted agents *neisseria gonorrhoeae* and *chlamydia trachomatis* are responsible

for the majority of serious cases, which, if left untreated, can lead to impaired vision or total blindness. The actual number of cases of ophthalmia neonatorum that result in blindness is difficult to estimate, but there is widespread agreement that the infection is one of the leading causes of permanent visual impairment in the developing world.

In 1880, the German gynecologist Karl Siegmund Credé invented a process appropriately named the Credé maneuver. He discovered that ophthalmia neonatorum could be prevented by putting a solution of 0.1 percent silver nitrate in the eyes of newborns immediately after birth. Although the technique is still in use, many developing countries have abandoned it because of the cost and potential toxicity of silver nitrate.

With IDRC funding, the department of medical microbiology at the University of Nairobi has undertaken research on the effectiveness of alternative prophylactic (preventive) drugs, including tetracycline.

The research took place in two phases beginning in June 1984 under the guidance of Dr J.O. Ndirya-Achola of the University of Nairobi and Dr Francis Plummer of the University of Manitoba. The study's initial objectives were to pinpoint the causes of ophthalmia neonatorum, including the role of *chlamydia trachomatis* and *neisseria gonorrhoeae*, and to determine the prevalence of the disease in the population.

Of the 1013 mothers enrolled in the study, 67 (6.6 percent), had gonococcal infections, and 201 (21 percent) had chlamydial infections. The babies contracted ophthalmia neonatorum from the infected mothers at a rate of 42 percent and 31 percent respectively.

“Our results from the first phase are clear,” emphasizes Dr Plummer. “The disease is a major health problem in Kenya, and without a doubt *chlamydia trachomatis* and *neisseria gonorrhoeae* are the principal etiological (causal) agents.”

This information became the basis for the natural question behind phase two of the research. What is the most effective and cost-efficient way to combat ophthalmia neonatorum?

The answer came by testing silver nitrate and tetracycline under controlled conditions. The Pumwani hospital, a small centre in the southeast corner of the city, became the centre of this research. For

more than a year, consenting mother-infant pairs participated in the study, with tetracycline being administered to 1499 newborns and silver nitrate to 1233. The relative efficacy of each method was then measured by comparing the number of mothers with gonococcal or chlamydial infections with the number of newborns who developed the disease. These results were then compared with those of phase one which involved no preventive treatment at all.

“It became clear during the course of our research that both prophylaxes are useful to guard against ophthalmia neonatorum, but we were particularly pleased to discover that tetracycline performed as well as, or better than, the more toxic silver nitrate,” says Dr Plummer.

Gonococcal ophthalmia, the most serious form of the disease, dropped from a rate of 42 percent with no treatment, to 7.3 percent when silver nitrate was administered, and to 2.2 percent with tetracycline. The rate of transmission also fell substantially for chlamydial ophthalmia.

These significant results were presented to health administrators at an IDRC-supported symposium held at Kisumu, Kenya, in January, 1987. Because the conclusions of the study were received with a “great deal of enthusiasm”, Dr Plummer hopes that officials will be encouraged to put tetracycline into use in all Kenyan medical facilities.

Putting tetracycline into general use could prevent over 16 000 cases of ophthalmia neonatorum per year in Kenya. The disease is both expensive and difficult to treat once contracted, making prevention imperative in a country that has few doctors and limited financial resources.

Sight is a human being's most important sense. The social costs of eye disease can be measured in the form of added care facilities and health workers, and the loss of economic production.

By applying research that can help people avoid this tragedy, doctors, in concert with administrators and social planners, have the opportunity to contribute to economic well-being while at the same time promoting human dignity and self-reliance. ■

Robert Harris is a freelance writer based in Toronto, Canada.



Marilou Kosseim examines a newborn's eyes at a special clinic in Nairobi.

CURSE OF THE BLACKFLY

SIERRA LEONE JOINS THE FIGHT AGAINST RIVER BLINDNESS

Researchers in Sierra Leone, West Africa, are helping sketch a detailed portrait of an insect-borne disease that often blinds people. In one district, 64 percent of the villagers tested for onchocerciasis were found to be infected.

Photo: Gerry Toomey — IDRC



For elderly blind villagers from Gbojeima, onchocerciasis means loss of livelihood and dependence on the young. The man is also suffering from elephantiasis.

GERRY TOOMEY

In Europe and North America, blackflies are more a nuisance than a health hazard. In spring, when rural streams and rivers flow fast and furious, these tiny blood-sucking insects of the genus *Simulium* breed by the millions. For most northern peoples, though, the damage rarely amounts to more than a few bites and a little local swelling.

But blackflies also thrive in the tropics, breeding in swift rivers and streams. In parts of Africa, West Asia, and Latin America, one species of blackfly, *Simulium damnosum*, is a threat to the health of whole villages. It transmits a tiny worm parasite to people, causing a disease known as onchocerciasis (on-ko-sir-ky-ah-sis). In severe, chronic cases, the victim suffers eye damage often leading to blindness. Hence the disease's common name, "river blindness".

The disease appears to have two main forms: forest and savanna onchocerciasis, the latter more often resulting in blindness.

Africa is the hardest-hit continent, with an estimated 17 million cases of onchocerciasis infection in 26 countries (World Health Organization estimates). West Africa's Volta River basin is one of the world's worst endemic zones. In this savanna area, it is not uncommon to see a blind adult being escorted by a child.

The largest and most successful organized effort to fight river blindness is the WHO-coordinated long-term Onchocerciasis Control Program (OCP) in 11 West African countries.

The respected Program for Appropriate Technology in Health (PATH), based in Seattle, U.S.A., notes that "almost none of the children born in the last ten years in 90 percent of the program areas have onchocerciasis. . . . The transmission cycle has been broken."

OCP appears to have wiped out onchocerciasis in most of the target countries through large-scale vector control, that is, by applying insecticides to eliminate the larvae of blackflies in rivers

Right: *Simulium damnosum*, carrier of the onchocerciasis parasite, breeds along rivers and streams.

Far right: Surgical removal of nodules full of adult worms reduces production of symptom-causing microfilariae.



Photo: University of Sierra Leone

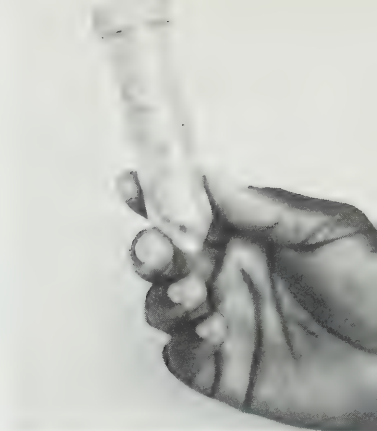


Photo: Gerry Toomey — IDRC

and streams. The program has also conducted research on new insecticides, chemotherapy, and diagnostic techniques, and launched resettlement projects in areas where the vector had been eliminated.

More recently, a drug called ivermectin has shown great promise as a treatment for the disease and possibly as a way to control its spread. (See box.)

With an estimated national infection rate of 9 percent, Sierra Leone has much to gain from a control program. Of the 300 000 people thought to be infected, some 10 000 have gone blind. The country officially joined OCP in 1986, one of the last four affected countries in West Africa to do so. Actual control efforts under OCP, however, have not yet begun.

OCP officials are concerned that blackfly strains from Sierra Leone, which transmit forest-type onchocerciasis, might invade areas where the savanna-type has been eradicated. To tailor blackfly controls to suit the situation in Sierra Leone, a more detailed picture of the disease's prevalence and intensity is needed, along with better information on transmission by the blackfly vector.

"You can't have a proper control program without good, dependable baseline data," explains Dr Aiya Gbakima, a parasitologist and leader of an IDRC-supported research project on river blindness in eastern Sierra Leone's Kono District. "The first and only [research] work done in that area was almost 65 years ago and nobody has done anything since then. Our work will save money, manpower and time."

As head of the University of Sierra Leone's Tropical Diseases Research Unit, Dr Gbakima and his team work out of Njala University College, in the southern town of Njala. In a separate project, the British Medical Research Council is also contributing to the data-gathering exercise for the Bo area.

The parasite that causes river blindness is the filarial (or threadlike) worm, *Onchocerca volvulus*. In infected human beings, it is present as both adult worms

and microscopic larvae called microfilariae. The adults live together, tightly coiled up in nodules, just under the skin, normally around the hips, knees, and chest.

Male worms grow to about 2.5 centimetres in length, but the females can reach 70 centimetres. During her 10-year lifespan, an adult female produces millions of microfilariae which also live just under the skin, but move around. Inside human beings, they don't mature into adult worms and therefore do not produce offspring. Their lifespan is only about 30 months.

Cycle of transmission

The transmission cycle begins when a blackfly bites an infected person, picking up microfilariae in the blood meal. Once ingested, the microfilariae go through three stages of development in various parts of the fly's anatomy. It is the third-stage larvae which the blackfly injects into the skin of another victim.

Inside the human host, the infective larvae develop into adult worms which mate and produce microfilariae. The cycle of infection thus repeats itself.

Dead microfilariae under the skin cause the main symptoms of onchocerciasis — severe itching, dermatitis, and blindness.

Onchocerciasis is a cumulative disease and affects people differently. Initially, the skin becomes dry, thick, and scaly, and is very itchy. This "onchodermatitis" usually starts in the lower legs, the blackfly's favourite biting location. It is accompanied by depigmentation — the appearance of white blotches called leopard skin — which may largely be caused by scratching.

With reinfection through more blackfly bites, new nodules appear. Other effects include fatigue, weight loss, blockages of the lymph system, genital swelling, and breast enlargement in females.

Constant reinfection over many years often leads to irreversible eye damage. As the microfilariae invade the tissues of the eye, vision problems develop, including

restricted visual field and acuity, and sometimes night blindness. As the cornea becomes increasingly scarred and hardened, the victim goes blind.

In the village of Gbojeima, less than an hour's walk from Dr Gbakima's laboratory in Njala, onchocerciasis is a fact of daily life. Here many of the 250 Mende-speaking villagers raise goats and chickens and grow subsistence crops. And to catch fish, they place nets in a stream which flows into the nearby Tia River.

At certain times of the year and especially after the rains, villagers are prone to being bitten by blackflies. The men, who clear land and work in the wooded areas, are especially at risk.

James Finoh, chief of Gbojeima for the past 17 years, is 57 years old and has chronic onchocerciasis. He used to work in nearby Njala, but then his eyesight began to fail.

"Last year [1986] I could see okay but then in June and July of this year it began to affect me," recounts the chief quietly, sitting in the shade of his house. Curious children and adults gather round to listen. An elderly woman struggles to pull up a stool someone has brought for her. She is blind, probably from onchocerciasis. Luckily she has a daughter to look after her.

"Right now I can make out those two children in front of me," continues Chief Finoh whose legs are extremely thin. "But I cannot see faces clearly or distinguish the colour of their clothes."

Dr Gbakima's IDRC-supported project on the onchocerciasis parasite began in May 1986. It has attempted to gauge infection levels both in human hosts and in blackflies.

The research team first won the cooperation of village leaders to conduct a study of about 600 people in three communities.

Questionnaires were used to obtain basic personal information (occupation, age, sex, etc.), as well as medical history such as previous surgical removal of nodules or drug treatment.

The researchers took two bloodless sam-

Onchocerciasis usually results in depigmentation and other changes in the skin, mainly in the legs.



Photo: Gerry Toomey — IDRC

ples of skin, called "skin snips", from the hip and shoulder of each subject, and treated them chemically. Later, back in Dr Gbakima's lab, the parasitic microfilariae in the snips were meticulously counted under a microscope to determine infection levels.

The study results show an overall infection rate of 64 percent, roughly comparable to results from other studies done in neighbouring areas. Rates varied from village to village, most probably because some communities are closer to rivers where the blackflies breed.

The infection rate for men (69 percent) was significantly higher than for women (58 percent), reflecting the fact that rural men are more likely to be bitten due to the nature of their work. Age was also a factor: 36 percent of subjects under 10 and 74 percent of those over 10 were infected.

Of those testing positive, 18 percent were considered heavily infected, that is, having 75 or more microfilariae per milligram of skin snip. According to Dr Gbakima, however, even lightly and moderately infected people are important in the disease equation since they constitute a reservoir of infection to keep the cycle of transmission going.

Treatment of onchocerciasis with the drug DEC (diethylcarbamazine) was given in cases where it was needed and not expected to cause serious side effects.

The rate of blindness among study subjects was 2.4 percent. (Results of eye tests to determine whether onchocerciasis was actually the cause were not available by press time.)

The research team also investigated the biting habits and infection rate among blackflies since this determines their potential for transmitting the parasite to people. Over a period of 18 months, young men were hired to catch flies according to strict guidelines. The insects were then dissected to determine the load of third-stage larvae.

Data varied from site to site and the researchers reached no firm conclusions

except that the blackflies' potential for carrying and transmitting infective larvae was high, especially between March and May.

Dr Gbakima's research has added another piece to Sierra Leone's epidemiological puzzle. He is optimistic that his results will contribute to WHO's overall control program. He also hopes victims in his own country will benefit. For he and

his team have armed Sierra Leone's Ministry of Health with another of the statistical arguments needed to attract badly needed funds to establish rural clinics. ■

Gerry Toomey is associate editor of Reports. Research assistance was provided by Colleen Thorpe and Edward Israel.

IVERMECTIN: THE GOODWILL DRUG

Ivermectin is a recently approved drug which is highly effective in treating onchocerciasis and which appears to be safer than other drug treatments.

Known commercially as Mectizan, it was originally developed by Merck Sharp & Dohme, a U.S. pharmaceutical company, to treat parasites in livestock.

In a goodwill gesture almost unheard of in the drug industry, the company announced last year it would provide the drug free of charge to approved onchocerciasis control programs. WHO has been working closely with Merck in clinical trials and other research. The drug was approved by France in October 1987.

An independent group of experts has nearly completed drafting guidelines on free distribution of the drug and procedures for applicants.

"WHO will work with us to make sure only the people who need the drug get it," said Robert Fluss, Merck's director of international public affairs. "We didn't want to just throw it out there."

In ivermectin field trials, so far 60 000 patients have been treated, with promising results. A total of 140 000 people are expected to be tested in

Liberia, Ghana, Burkina Faso, Mali, and other countries.

IDRC is now in discussions with a team of Ivorian scientists over a possible research project to test ivermectin on forest-type onchocerciasis.

Both DEC and suramin, the standard drug treatments for onchocerciasis, cause severe side effects and therefore can't be safely used to treat whole populations. Although DEC, the more widely used, is effective in killing microfilariae (but not adult worms), it sometimes causes irreversible eye damage, thus defeating its purpose. It also causes a severe allergic reaction and treatment takes 10 to 12 days under a doctor's supervision.

Ivermectin has a number of advantages. It can be taken as a single oral dose which remains effective for a year. It kills microfilariae without causing a severe allergic reaction, and its other side effects — headaches, nausea, and dizziness — are relatively minor.

Because it is easy to administer and appears safe, it may have enormous potential, not only in treating individuals, but also to break the cycle of infection in populations at risk. ■

EXTRACTING PROFITS WITH A SHEA BUTTER PRESS

DENIS MARCHAND

In the tiny village of Gladié in southern Mali, shea butter isn't usually a major topic of conversation. But it is a useful product in everyday chores such as cooking millet cakes or waterproofing the family hut.

In the latter case, a shea-oil-based coat is applied along the doors and windows of a dwelling, as well as to the base of its earthen walls, in order to protect against seasonal rains.

There is one occasion when shea butter does become the centre of attention. That's when the village women go to their storehouses to collect the fruit that they have patiently harvested from beneath the large shea trees which grow wild in the region.

For more than two days, the women spend their time heating and shelling the shea fruit, pounding the nuts found inside, and working the mixture with their hands and arms to extract the precious shea butter, which looks like thick oil. Even when this traditional process is carefully carried out by village artisans, only about 30 per cent of the fruit's fatty content is extracted.

"Without actually becoming rich, the small producers would at least earn more money if they could extract a larger proportion of the shea butter from the processed fruit, and at a faster rate. Unfortunately, in the absence of an appropriate technology, the natural wealth of the shea tree is not fully exploited," comments Badji Tounkara, an employee of the farm equipment division of the Ministry of Agriculture.

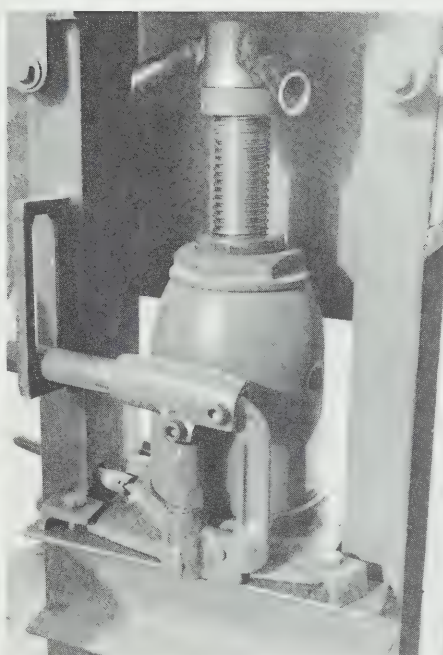
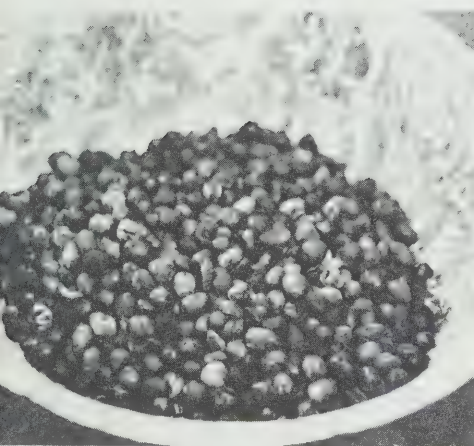
Production constraints aside, there is still a strong demand for shea butter in Mali. Not only is it an important element in the rural diet, but its biochemical components are highly prized as raw materials in the manufacture of pharmaceuticals and cosmetics, especially ointments, beauty creams, and soaps.

Ointments are used in massages for children and pregnant women, for treating inflammations and skin problems, and for preventing dry skin. SEPOM, a Malian company, processes shea butter on an industrial scale and manufactures a beauty

Photos: Denis Marchand



Traditionally the nuts are pounded, then the mixture is hand-stirred for two hours. This tiring task allows the oily substance to separate from the flesh of the nuts and come to the surface. Below, shea nuts are pressed under a screw jack. The oil extract congeals quickly at room temperature and turns into shea butter. The cake-like residue is used as fertilizer or as food for livestock. The shea oil is also used to waterproof around the base of the huts and around windows.



cream which is as popular in West Africa as it is in Europe.

For small and medium-scale producers, there is now good reason to be hopeful. The Ministry of Agriculture's farm equipment division, with IDRC assistance, has developed a shea butter press which has proved out in initial tests.

Equipped with a jack which exerts 30 tonnes of force, this machine crushes more than three kilograms of shea fruit in 20 minutes. It extracts up to 85 percent of the fatty material contained in the fruit — a tripling of production — and the resulting shea butter is of much better quality. The press also simplifies the whole process. In particular, it permits a reduction in the cooking time of the fruit, which in turn saves fuelwood, a precious commodity in this seriously deforested region of the Sahel.

Finally, the shea butter press also makes it possible to retrieve oil cake from the process. A second pressing of the oil cake yields a lower-grade oil which can be used as a base for dyes or as waterproofing. When applied to a house, it protects the clay from the rain. It can also be applied to beehives to make them watertight.

The oil cake has other uses too. It can be fed to animals, applied as fertilizer, or burned as fuel. Even the resulting ashes can be used to make potash.

Prototype units were initially constructed by the farm equipment division. But now, with the exception of the jack which is imported from Europe, the presses are built by young local artisans. Formerly engaged in the construction of farm equipment at the Ministry of Agriculture, these artisans joined forces to set up their own operation.

Production is going well. More than 50 presses are now being tested in Mali, Burkina Faso, and Ivory Coast where shea trees grow in large numbers. The users, usually groups of small-scale producers, hope not only to satisfy their own domestic needs, but also to sell any surplus shea butter or its by-products in order to increase their incomes. ■

Denis Marchand is a Canadian freelance photographer and journalist based in Montreal.

EVERY CLOUD HAS A SILVER LINING

Giant nylon nets are being used experimentally to extract drinking water from the daily fog that shrouds the otherwise arid mountain slopes of the Chilean coast. Preliminary tests suggest that such a system can provide small communities with an adequate supply of drinking water at a fraction of the cost of trucked-in spring water.



Photos: R.S. Schenbauer

DANILO ANTON

For the numerous fishing communities along the desert coast of Chile and Peru, drinking water is a precious resource.

In the case of the Chilean village of Caleta Chungungo, its inhabitants depend almost entirely on natural spring water delivered by an old truck once a week from about 50 kilometres away. This water isn't necessarily safe and, at a cost of CA\$10 per 1000 litres, is very expensive. To make matters worse, the weekly 10 000-litre water supply — about three litres per person per day — simply isn't enough to meet people's needs.

Families with higher incomes can buy more water than others. Some of the water is used to wash fishing equipment, reducing its availability to the poorest families. In fact, in some homes daily water con-

sumption hardly exceeds one litre per person.

Besides water, the tanker truck is also sometimes used to carry fuel and other cargo — even people! Naturally, there are health problems associated with the use of this water. And when delivery is interrupted — for example, if roads become impassable after one of the region's rare rainfalls, or the truck breaks down — families must obtain water from local sources which are often inadequate and polluted.

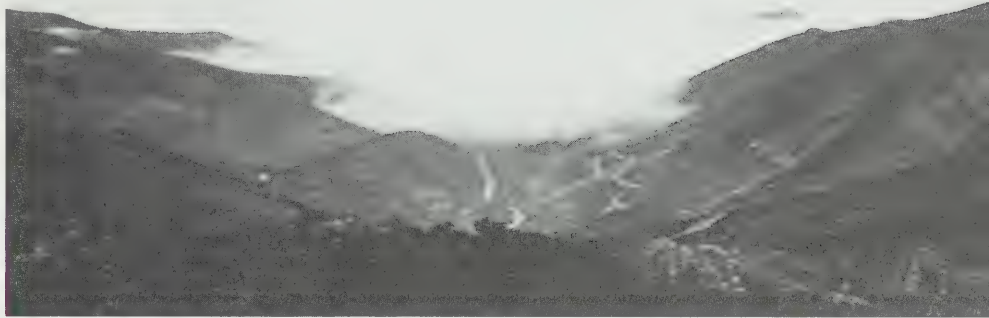
Unfortunately, natural sources of safe water do not exist near the village of Caleta Chungungo. At 100 millimetres per annum, rainfall is scarce and there are no streams that run all year round. As a result, only poor-quality brackish water, which is inadequate for most domestic uses, is obtained from a few nearby springs, and

water-borne diseases are therefore widespread.

Despite these difficulties, there is hope for the small communities along the coast of Chile and Peru. Like other coastal deserts on the western side of the main continental land masses in the tropics and subtropics, these areas are subject to three particular climatic phenomena: cold ocean currents flow north past them to lower latitudes, masses of cool air move in from the antarctic, and there is an upwelling of deep ocean water.

The combined effect of these phenomena is a general cooling of the ocean surface and the lower layers of the atmosphere, as well as reduced evaporation. Contact between the top part of this cold air mass and the warmer air above it produces a relatively uniform condensation of atmospheric water vapour.

Huge nylon nets are used to trap water at El Tofo where it almost never rains. Right, the clouds that provide the village with potable water.



The condensation takes the form of a more or less permanent cover of low, thin clouds which give rise to the typical features of coastal desert climates: cool temperatures, low rainfall and, of special importance, frequent fog. The desert coast of Chile and Peru experiences this apparently paradoxical climate in which there are clouds without rain and drought in a humid atmospheric environment.

The border region between Peru and Chile, near Arica, is inhospitable. Rainfall is as little as 0.7 millimetres per year, sources of drinking water are scarce, soils are rocky or sandy, and there is little vegetation.

Despite the harsh climate, the region still manages to retain a sizable population. The reason is simple: the same conditions that prevent rain also make this one of the best fishing regions in the world.

Moreover, the hinterland of the coastal desert possesses considerable mining resources. Deposits of copper, tin, silver, lead, and iron, for example, could be more fully exploited if the water resources necessary to support a larger number of workers were available. Such development would bring new wealth to this historically poor area.

Nevertheless, the lack of water resources is more apparent than real. The quasipermanent cloud cover contains a substantial amount of water which, if tapped, could provide a significant source of drinking water for the local population.

"Camanchacas" is the local name given to the coastal fog that occurs when thin "stratocumulus" clouds hit the slopes of the coastal mountain range. This is an almost daily occurrence during most of the year and affects a 200- to 300-metre vertical stretch of the mountain slope.

Although the altitude of the clouds varies from almost sea level to a little more than 1000 metres, they normally remain between 400 and 900 metres. Slopes within this elevation range are often covered with fog. Every afternoon sea breezes push the fog inland and at night land breezes sweep it back out to sea.

Some natural forests (as in the area south of La Serena, Chile) have developed and survive in low rainfall areas, mainly due to the supply of water from the Camanchacas. It is widely believed that

such forests at one time covered most of the sea-facing slopes of the coastal range.

A number of imaginative researchers have proposed that the Camanchacas be tapped as an alternative source of fresh water for coastal communities. As far as anyone knew, such fog collection had never before been attempted for the purposes of communal water supply. The idea therefore met with some skepticism and financial support was slow to come.

In the late 1970s, several experimental fog collectors were tested near La Serena with funding from Unesco. But to no avail. The tests were not conducted in light of the local population's needs.

In 1984, however, Chile's two main universities, the Universidad de Chile and the Pontificia Universidad Catolica de Chile (PUCC), collaborated with the Regional Planning Secretariat (SERPLAC) and the National Forestry Corporation (CONAF) in asking IDRC support to continue the research. The Atmospheric Environment Service of Canada's Ministry of the Environment was asked to collaborate on the project.

Two parallel studies have been carried out. One was under the supervision of Ms Pilar Cereceda from the geography department of PUCC. It focused on the geographical distribution of fog occurrence, at both the regional and local scales, in relation to the potential water requirements of coastal communities. To this end, the study team surveyed 45 coastal settlements in the Atacama region.

Subsequently, several dozen small fog collectors called "neblinómetros" were installed in various locations to estimate the quantity of available water. This was compared with community demand. The field data were correlated and interpreted on a regional basis. At El Tofo, 6 kilometres from Caleta Chungungo, more precise studies were carried out using both meteorological instruments and the neblinómetros.

The first large-scale fog collectors ("atrapanieblas") were also installed at El Tofo. Made of a double layer of locally available nylon mesh, each of these fence-like structures measures 12 metres long by 4 metres high and is suspended one metre off the ground on poles. Fifty atrapanieblas have already been installed. The out-

put from the collectors, which is stored in a large tank, is measured with a new low-cost flowmeter designed by Canada's Atmospheric Environment Service.

Preliminary figures indicate an average output of 237 litres per day per atrapaniebla collector — or about 5 litres per square metre per day. Although the 14-day test period is probably not representative of the whole year, it gives a close approximation of the collector's potential.

Even if each collector were to produce only 4 litres per square metre per day, the daily total for the planned 60 collectors would be more than 11 500 litres — or eight times the current fresh water supply to Caleta Chungungo. It is expected that some design improvements, introduced as a result of the first tests, will make the collectors more efficient, perhaps increasing the water yield by 10 to 20 percent. This would translate into a total gain of up to 2300 litres per day for the overall system.

During the testing, a large number of studies were carried out by Dr Robert Schemenauer of the Atmospheric Environment Service and Drs Humberto Fuenzalida and José Rutland of the University of Chile. Included in this work was the use of an airborne meteorological system to periodically record temperature, relative humidity, pressure, and wind speed from ground level to an altitude of several thousand metres. The researchers also measured the density and size of water drops (both upwind and downwind of the collectors), as well as the volume of water produced.

At the same time, samples of the water taken from the system's outlet were analyzed to ensure it is safe for drinking and other household uses.

If these encouraging preliminary results are confirmed, the people of Caleta Chungungo will finally have access to an adequate and inexpensive supply of drinking water thanks to this unique fog-harvesting system. It is estimated that the cost of Camanchacas water could end up being as little as one-fifth that of trucked-in spring water. If so, the technology could be successfully applied at other locations along the coast of Chile and Peru, and probably at other similar sites in the world. ■

Danilo Anton is a program officer in IDRC's Earth and Engineering Sciences Division.

PROTECTING THE GARDEN

Photos: Ernest Koama



*The province of Sanguié, in the West African country of Burkina Faso, has a long tradition of market gardening. To protect crops from wind and browsing animals, farmers often construct fences using dead millet stalks. Over the past two years, though, farmers have become familiar with an alternative — “living fences”. An experiment in which a tree called *Acacia nilotica* is grown in the form of hedges has produced impressive results. And the advantages of this kind of fence have been amply demonstrated at the farmers’ cooperative in the village of Guido.*

HAMADO OUANGRAOUA

Just outside the village of Guido, about 30 market gardeners live on the hillside bordering a reservoir of milky, clay-coloured water. Sheep, cattle, and goats graze under denuded cherry trees and shea trees whose crowns have been yellowed by the dust of the African harmattan winds.

For generations, the gardeners have protected their crops with millet stalk fences. But experiments with living fences over the past two years are giving positive results and could make millet stalk fences a thing of the past. Living fences now extend 400 metres along the west side of the plot belonging to the Guido farmers’ cooperative. For a community that has always placed great value on individuality, this collective effort is a noteworthy achievement.

Mathieu Bagnama, a forestry extension worker from the neighboring village of Réo, is in charge of providing information and follow-up on the living fence experiment. His relationship with the villagers is good. The fact that he shares their culture enables him to understand their strong points and avoid offending them on touchy issues. He has thus been able to turn their individualism to advantage, assigning each person a share of the work.

Once the layout of the hedge had been determined, each farmer was given a section of earth to dig, plant, and tend. Not all the farmers were enthusiastic, but none shirked his responsibility.

Acacia nilotica, the local tree species used in the hedge, is thorny and grows rapidly. It doesn’t require much care; in fact, most of the farmers haven’t had to water at all since the hedge was planted. If planting is done at the beginning of the rainy season (June-July), watering isn’t necessary. If done later, light watering for the first few months is sufficient.

When the hedge was planted, the young plants were protected and helped along by the old structure of millet stalks, now infested with termites. “You have to prune the hedge and plug any gaps that appear as the plants grow,” explains Rafael Sandaogo, one of the farmers. His 14-year-old son adds that millet fences require a lot of work, and the stalks cannot then be used as heating fuel or fertilizer, or for other domestic purposes.

Salif Kaboré is a farmer who has come

Left, Mathieu Bagnama, a forestry extension and field worker from Réo. After two years the acacia bushes give shade and are an effective barrier. Right, a fence made of dead plant stalks.



from Boassa to see the living fences for himself. He knows the value of safeguarding his agricultural investment: "Without protection, it is pointless to grow anything. Animals will eat it all. This year, we asked our extension workers for wire fencing, but they advised us to work with less expensive materials until our profits are larger. We decided to protect our gardens with 'seckos' (mats). Some we made out of long grasses, and some we bought. But now I think we'll build a hedge like this one."

Digging furrows in the Sahelian sun is hard work, but Joseph Dakouré, the oldest of the market gardeners visiting the co-op says: "There's nothing complicated about the work. The seeds are no problem — the plant grows wild all around here. If the seeds are sown in June or July, you don't even have to water them. Digging is hard, but you only have to do it once. I know this species, *Acacia nilotica*. Afterwards, you just have to trim the extra growth and use it to fill the gaps."

Living fences are a lifetime investment. There is no need to replace stakes or find straw to weave into mats. Careful pruning is basically all the care required. The hedges also have many secondary advantages. If used in conjunction with a windbreak, for example, they can help to conserve moisture and reforest the land.

Their leaves provide the fields with valuable organic matter, and their roots prevent erosion.

In addition to the members of the cooperative, several villagers have adopted this method themselves. Paul Kinda's hedge is just six months old. He has been experimenting with sisal hedges for 30 years, but finds them unsatisfactory. A year ago he planted *Acacia nilotica* in bunches, but this did not prove successful. He is now using the method recommended by the forestry extension worker.

Eugène Bernardin is just one of his many neighbours to follow suit. In fact, the village nursery has absolutely no *Acacia nilotica* left in stock!

Cost advantage

The use of living fences obviously involves a monetary advantage as well. The price per metre of wire mesh fence, for example, is high: 1400 CFA francs (CA\$6). And in the case of the Boassa market gardeners who installed woven mats all around their plots, they had to borrow 60 000 CFA (CA\$260) from a local NGO.

Minor obstacles remain, however, such as the supply of plastic pots, which are vital to the development of farm nurseries. Forestry researcher Goudouma Zigani, the project manager from the Ministry of the Environment, feels that this is a priority if

production costs are to be kept down.

Lastly, other methods of cultivating the land and planting the hedges are currently being tried in Gonsé, near the capital. "In six months, we will have the results of these experiments. We hope to find a solution that involves as little inconvenience and expense as possible for the farmers," says Mr Zigani. ■

Hamado Ouangraoua is a journalist from Burkina Faso. He writes for Carrefour africain, a weekly government publication.

FENCES: LIVING VS DEAD

In the Sahel, cutting down trees or even some of their branches to build a fence carries a heavy cost — it encourages desertification, which is already happening very rapidly in this part of the world.

Market gardeners haven't enough money to buy wire fences to protect their gardens from grazing cattle. And if they weave fences out of plant stalks, that material is thus not available for other important purposes.

The solution may lie in the use of hedges — "living fences".

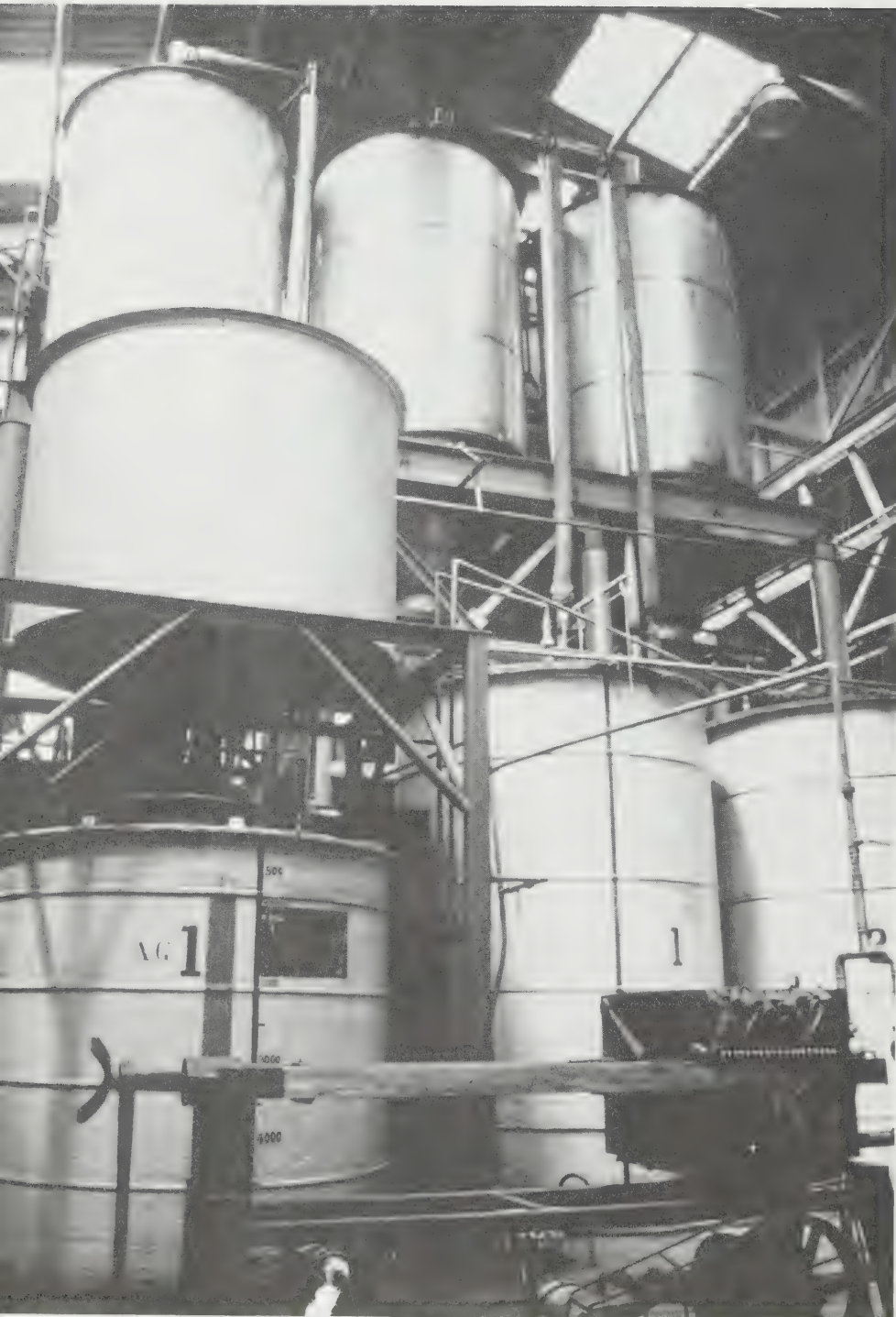
Since 1983, Burkina Faso's Ministry of the Environment and Tourism has been operating an IDRC-funded program to popularize the use of the hardy tree species in hedges. Researchers Goudouma Zigani and Fidèle Hien have selected and tested a number of species — *Acacia nilotica*, *Bauhinia rufescens*, and *Prosopis juliflora* — in about a dozen regions, representing the Sahelian, sub-Saharan, and Saharan zones.

In conjunction with nongovernmental organizations that help to promote market gardening, the forestry extension personnel have been able to obtain the cooperation of local villagers. The provinces of Sanguié and Bulkiemdé are the object of a special effort, as off-season vegetable production there is well developed, and farmers are eager for a substitute for wire fences. ■

PINE TREES AND LEATHER

CHILE GROWS ITS OWN TANNIN

Photos: R. Charbonneau — IDRC



Equipment at the DITECO plant. In these giant "teapots," the bark, which has been reduced to powder, is combined with warm water to release the tannin.

ROBERT CHARBONNEAU

On both sides of the road, the tall pines reach up to the blue Chilean sky. The surveyors have done their work well: each tree is aligned with its neighbours, making the forest look like an immense checkerboard.

The only distraction from this impressive view is the heavy, log-laden trucks speeding down the road toward the mills at Concepcion, where they will be stripped of their bark and cut into lumber.

In a few minutes, we will reach the DITECO plant where the natural acidic compounds needed to tan leather — tannins — are extracted from pine bark.

Every year, the Chilean leather industry imports 4000 tonnes of natural plant tannin, mainly from neighbouring Argentina, to process 20 000 tonnes of leather. This costs more than US\$2.5 million (1982 figure). Usually made from the bark of the quebracho tree (*Schinopsis lorentzii*), the tannin powder is an essential ingredient in the industry.

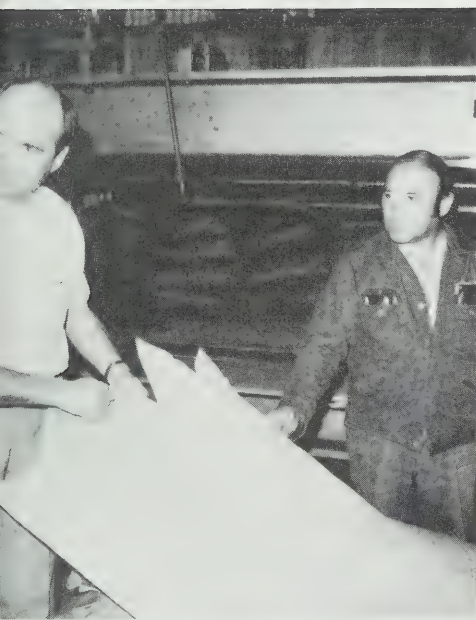
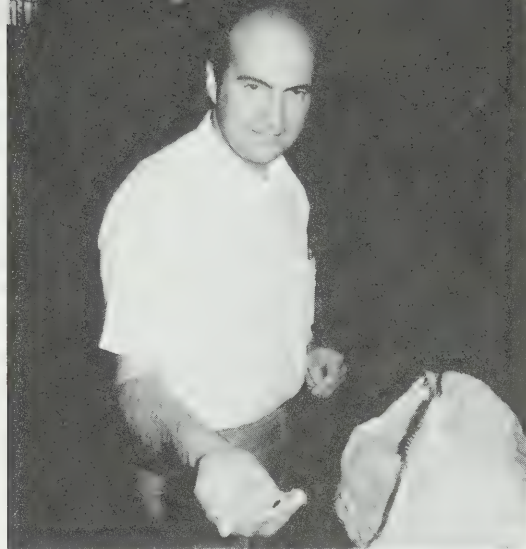
The tanneries also use chemical agents such as chromium salts, but in smaller quantities — barely 600 tonnes per year. Although less expensive, chromium salts are not of the same quality as natural tannin powders which produce the excellent, durable leather ideal for shoe soles.

Until the mid-1950s, domestically produced natural plant tannin was readily available to Chile's tanneries. In particular, shrubs such as algaroba (*Balsamocarpon brevifolium*), whose fruit contains up to 65 percent tannin, were used. Unfortunately, these shrubs have all but disappeared because their fruit — and consequently their seeds — were overharvested. Algaroba is now found in just a few scattered areas of Chile. Only local mountain residents still grind the fruit to tan skins or dye wool.

The scarcity of natural plant tannin aroused the interest of Chile's Forestry Institute (INFOR). Johannes Wrann, an INFOR forestry engineer, wondered whether it would be possible to find enough tannin in Chile to meet commercial requirements and, if so, which extracts would be most appropriate for industrial use. INFOR obtained financial assistance from IDRC to study these questions.

First, Mr Wrann studied the possibility

Mr Tauler from the Gacel tannery holds Algaroba powder which is becoming more and more scarce.



The quality and type of the tannin is very important in treating leather for shoe soles which must be strong and abrasion-resistant.

region of the country.

While Mr Wrann continued his research to improve the pine tannin technology, Hans von Leyser, director of operations at DITECO, was busy putting the extraction process to the test. Mr von Leyser explains that the finished product may vary considerably, depending on the quality of bark used. "We are now conducting tests with bark that has been hand-picked and cleaned of various residues such as dirt and sand. But we also use mechanically picked bark which contains various undesirable substances."

At present, DITECO produces a tonne of tannin per day from pine bark provided by local sawmills. Several tanneries in Concepcion, including the Villanueva and Gacel tanneries, are testing DITECO-extracted tannins.

The experiments are conclusive. The extraction process is technically acceptable and commercially profitable.

Indeed, the owner of Gacel tannery, Mr. Tauler, expresses satisfaction with the leather produced using a combination of imported quebracho tannin and local tannins extracted from pine and algaroba. "Pine products have a future in local tan-

neries, as do natural plant tannins in general," he says confidently. "Chromium salts, which are highly pollutant, are already banned in Europe and, undoubtedly, will soon be banned here too. Natural plant tannins are increasingly in demand."

Research is providing all the requirements to meet this demand. Not only has it been able to show the feasibility of recovering pine wastes and reforesting arid areas with tannin-producing species, it is also demonstrating the high quality of the resulting leather.

DITECO is now operating at full capacity and enhancing its production methods. With IDRC support, INFOR researchers including Johannes Wrann are working on methods of planting and maintaining trees in arid regions of the country. Among other things, they are thinking of developing the use of exotic species such as eucalyptus (*sideroxylon* or *astringens*) and acacia (*mearnsii* or *pycnantha*) which grow quickly in Chile. The bark of these trees contains between 30 and 40 percent tannin. Eucalyptus is also of interest to the building and furniture industries, and acacia produces high-quality pulp. ■

of replacing algaroba with trees and shrubs with a higher yield of tannin. Initially, he and his colleagues conducted regeneration trials with algaroba. They experimented with soil mixes, watering frequency, and protection of young plants against parasitic fungi and rodents which seem to have a particular taste for the peanut-like fruit.

After two or three years, each shrub can produce about 400 grams of tannic material. This is fine for small-scale producers in remote regions, but is inadequate for commercial use. The researchers came to the same conclusions for tara (*Ceasalpina spinosa*), reputed to produce excellent tannin. Here again, the plant does not grow in sufficient quantities for commercial exploitation. Mr Wrann therefore turned to plant species widely used in Chile — such as pine (*Pinus radiata*), of which there are 1.2 million hectares planted. The lumber industry considers bark a by-product useful for heating mills. Mr Wrann contends that pine bark, which is 17.5 percent tannin, could be of major benefit to the leather industry in the Concepcion

NO LEATHER WITHOUT TANNIN

Tannins are acidic plant compounds used to treat, or "tan", hides. They react with the tissue in the animal skin, preserving its flexibility and making it resistant to rot.

The ancient Egyptian and Babylonian civilizations knew the craft of treating hides. Today, natural plant tannins are still widely used in the leather industry, but synthetic chemical tannins such as chromium salts, which are pollutants, are also used.

Natural plant tannins are of particular interest to the footwear industry, since they produce very durable leather, especially useful for manufacturing shoe soles.

Tannins differ from tree to tree. The durability and colour of leather are determined in part by the type of tannin used.

The DITECO tannin plant, in Chile,

gets its supply of pine bark from local sawmills. The highest concentrations of tannin are found in the bark around the base of mature trees (20 years).

The bark is crushed and then loaded into tanks with water heated to 80 degrees Celsius. "It is a little like brewing a huge cup of tea," comments Hans von Leyser of DITECO. The liquid is kept in motion and the water temperature is monitored. The mixture is then cooled and decanted. An evaporator removes the excess liquid.

The tannins are delivered to the tanneries in liquid or powder form. Powdered tannin is manufactured using equipment similar to that used by dairies to dehydrate milk. This last, optional stage makes the finished product slightly more expensive, but this is often offset by reduced transport costs. ■

'UNDERSTAND THE FARMERS BEFORE INTERVENING'

MALIAN RESEARCHERS ON INNOVATION

Photos: Denis Marchand



Makam Diara in front of his animal enclosure.

DENIS MARCHAND

"It's hard to imagine, but two years ago I left my cattle out in the bush for the whole dry season with a herdsman to watch over them for me," recalls Mr. Makam Diara, the first farmer in the Malian village of Sakoro to corral his cattle.

"They went looking for food and water and then came back when the rains came. But sometimes they were too weak or too late to do the farm work on time.

"Now I keep them on my land. They stay in the enclosure during the night and for part of the day. I feed them on what's left over from the harvest. They're healthy and well cared for, and ready to work when the rains come. And they provide fertilizer that my fields really need."

Every day, Mr Diara takes his 40 milk and draft animals out of the enclosure and cleans it. He saves the manure and food scraps and later spreads the mixture on fallow land or fields under cultivation.

During most of the day, the cattle feed on maize and sorghum stubble in the fields. They drink from the stream and graze nearby, under the watchful eye of Diara's 10-year-old son.

Like most of his counterparts in southern Mali, Mr Diara used to be a subsistence farmer who practiced shifting agriculture. After clearing a plot of land, he would burn off all remaining vegetation and grow sorghum and cowpeas until the soil was exhausted. When harvests became too small to adequately feed his family, he would abandon the plot and clear another.

Today, the use of organic fertilizer and better soil management allow Mr Diara to grow not only maize and millet for his own use, but cotton which he sells to the Malian Textile Development Company. Anticipating good harvests for the next few years, he has built himself a granary to protect his crops from rain, moisture, and rodents.

Like Mr Diara, several other farmers from Sakoro and the surrounding area have changed their planting and stockraising methods. They are using slash-and-burn less and less, working their fields with a plough, and fertilizing for better harvests. Small farmers are growing millet, sorghum, maize, peanuts, and cotton on land they had previously exhausted. In less than two years, Sakoro's grain production has gone from half a tonne to 2½ tonnes per hectare. Cattle are kept in collective or private corrals.

This change in farming habits and attitudes is the result of sustained efforts initiated in the early 1980s by the Rural Economics Institute of Mali's Ministry of Agriculture. The purpose of the agricultural development program it set up was to encourage the growth of maize and the use of manure and compost in the Bigouni-Sikasso area, which suffers from frequent dry spells and an alarming shortage of food.

Mr Moulaye Sangaré, a livestock officer with the division of rural production systems research, describes the project: "We weren't trying to implement anything revolutionary. Our main goal was to set up an information exchange between two groups of people — the farmers, who have the practical experience and knowhow, and the researchers, whose strong point is scientific theory. That's why the members of this extensive research project on farming systems, the first of its kind in Africa to be funded by IDRC, began by *listening* to the farmers instead of telling them what to do. They established a dialogue with the farmers right from the outset, and made them equal partners."

For Mr Sangaré, any development strategy that does not take into account the farmers' environment and goals is destined to fail.

Thus, in Sakoro and three other similar villages, the farmers have become part of the process, from program planning to evaluation. The research team members — an agronomist, an economist, a sociologist and a livestock officer — meet with the farmers on a regular basis (under the only tree in the area), taking note of their impressions and comments, and their suggestions as to the cause of poor yields.

The team also works with the farmers in order to identify their needs and aspirations, and the social, economic, and cultural constraints they face.

According to Mr Sangaré, this multidisciplinary approach has shown that the rural populace is not homogeneous, but very diverse. Large roadside villages do not have the same problems as the small isolated villages surrounded by countryside. And wealthy farmers don't have the same concerns as poor ones.

Project economist Hamadis Doucoure underlines the importance of economics in technology adoption: "It is important to know whether the proposed techniques are feasible and in keeping with the finan-

cial constraints on the region. Transport costs, for example, can paralyze a project completely. Why should a farmer grow vegetables if he can't take his crop to market because of poor roads? And why consider dairy farming if you don't have the financial resources to buy and feed cattle, let alone care for them properly?"

Mr Doucoure stresses that innovation generally involves financial risk. It must be recognized that in a situation of permanent hardship, the farmer's investment is based on the resources available at a given moment, not on hypothetical profit. His or her goal is not to maximize output but to ensure a livelihood for the family, regardless of production conditions.

When the research team arrived in Sakoro, even those farmers who had ploughs were not using them. The reason for this, explains agronomist Mamadou Abdul Kadai, was that no one had shown them how! "With no technical advice or training, the farmers were taking too long to plough the fields, and missing the first rains which are so important to crops. Or they would plough too deep and the seeds would rot with the result that, for all intents and purposes, the crops were lost. So the ploughs, which had been donated by expatriates or international organizations, were simply put aside. No one wanted to risk losing a crop just to try out a new technology."

Progress might seem slow to some experts, but it is definitely occurring — at a pace that suits the farmers, who, after all, are the ones taking the risks. New techniques being tested in Sakoro, Gladié, Flaboula, and Monzondougou are the talk of the region. People from neighboring villages watch the changes taking place and try to find out more about the new methods from friends and relatives. Some are getting very interesting results — which goes to show that farmers are not always resistant to change.

For Mr Kadai, the agronomist, new technologies are rejected because they fail to take into account the physical and economic environment in question, and because of a complete lack of understanding of the social dynamics of the target populations. "These villagers live in a different environment. They have their own methods for raising crops and animals. Their logic and way of life are based on personal experience and oral traditions handed down from generation to

Moulaye Sangaré, agronomist and livestock officer: "Listening to farmers is essential."

generation. It's important to realize how these cultures function, and the deep-seated reasons behind their actions."

Although it isn't unusual for new farming methods to be rejected by the farmers, neither is it unusual for the research team to modify its approach in order to collect the information it needs for its work — information that cannot be found on a research station. The knowledge and test results obtained right on the farm make it possible to identify new thrusts, and, if necessary revamp original plans.

"Farming systems research is a kind of bridge between basic research and development," says Mr Sangaré, for whom the systems approach is vital to enlightened decision-making. "It provides input for the conduct of basic research and encourages development. In addition, the multidisciplinary approach eliminates the prejudices of some local and foreign experts, who think that things are so bad that anything they do will improve the situation."

"Even if solutions are valid for one case, they must be adapted to the realities of each region, which are often very different." ■

Denis Marchand is a freelance photographer and journalist, based in Montreal, Canada.

COPING WITH THE GREENHOUSE EFFECT

...CROP DIVERSIFICATION IS ONE ANSWER

JOHN EBERLEE

By the year 2025, the Earth will likely be a warmer place to live and will shelter some 8 billion people — about 3 billion more than at present.

Whether humankind can successfully feed those extra mouths may depend on our ability to predict and prepare for climate change, said Dr Suresh Sinha, Professor of Eminence at the Indian Agricultural Research Institute in New Delhi. Dr Sinha was speaking at the International Conference on the Changing Atmosphere, held in Toronto, Canada, last June.

Prior to his presentation, other scientists warned conference delegates that they could expect the global "greenhouse effect" to increase average annual temperatures by between 1.5 and 4.5 degrees Centigrade. The full warming effect might appear by the time the human population tops the 8 billion mark.

Most of the predicted global warming will come from future emissions into the atmosphere — emissions of carbon dioxide, methane, nitrous oxides, chlorofluorocarbons, and lower-atmosphere ozone. A substantial proportion of these so-called greenhouse gases are the product of human activity such as driving automobiles and felling forests.

Solar radiation that strikes the Earth is normally re-radiated back into space as heat energy. Greenhouse gases, however, trap some of this heat thereby increasing the temperature of the atmosphere. The scientific consensus is that if we immediately stopped all emissions of greenhouse gases — an impossible task — we would still face a global temperature increase of 1 degree because of gases already aloft.

Threat to farmland

The greenhouse phenomenon could result in a decrease in the available arable land in developing countries, said Dr Sinha. As temperatures rise, so might sea levels by up to 1.5 metres. For low-lying grain-growing regions, like the Ganges River delta in Bangladesh, the consequences could be disastrous. Higher temperatures may also transform already marginal farmland into desert, assuming rainfall doesn't keep pace with temperature.

Studies from several countries show that some crops, like wheat, may fare poorly when the thermometer climbs. More carbon dioxide in the atmosphere will benefit all plants, but temperature increases above 1.5 degrees will neutralize this effect. Crop yields may actually decrease where irrigation isn't practiced.

Not all the news is bad, however. "Overall, rice production may remain unaffected and maize may increase," said Dr Sinha. "Wheat belts may be replaced by barley, barley by maize, maize by sorghum and so on."

Dr Sinha predicted that coping with tomorrow's unstable weather could become one of the most serious challenges for agriculture. Global warming could summon more floods, droughts, even cold snaps in some regions. He recommended that governments encourage crop diversification to cushion their populations against the shock of climate change.

Although agriculture is likely to be a major victim of the greenhouse effect, it is also one of its causes. For example, clearing forests for agriculture adds carbon dioxide to the atmosphere, and irrigated rice fields release significant amounts of methane.

Farmers in the next century will be asked to walk a thin tightrope — reducing

greenhouse gas emissions from agriculture while, at the same time, expanding food production to meet domestic needs. Dr Sinha said there is plenty of potentially arable land in Africa and South America. However, if governments encourage farming at the expense of tropical rain forests it will only exacerbate global warming. He said food production increases should instead come from sound management of water, crops, and postharvest activities.

The conference's Working Group on Food Security, one of 12 groups charged with recommending ways to cope with climate change, echoed Dr Sinha's view. The statement called for intensified research into ecologically sound farming practices, plus increased cooperation between countries on agricultural matters. ■

John Eberlee is a freelance science writer based in Ottawa.

A HOME FOR THE BRUNDTLAND PAPERS

Photo: K. Pendergast

Researchers around the world now have access to the archival papers of the World Commission on Environment and Development (WCED), also known as the Brundtland Commission.

At the World Conference on the Changing Atmosphere last June in Toronto, Canada, Mrs Gro Harlem Brundtland, Commission chairman and prime minister of Norway, announced the transfer of the collection to IDRC. The documents were entrusted to IDRC because of its international character and commitment to sustainable development.

The library at IDRC headquarters in Ottawa will be the permanent home of the complete original collection. At the same time, the chairman of IDRC's Board of Governors, Dr Janet Wardlaw, presented Mrs Brundtland with the first of three CA\$17 000 contributions to the Geneva-based Centre for Our Common Future. The centre was created as a focal point for follow-up to the Commission's recommendations.

The collection includes practical recommendations for sustainable development as well as detailed instructions for their implementation.

Documents in the collection are indexed by corporate author, title, and subject. Bibliographic references are



Commission Chairman Gro Harlem Brundtland with IDRC President Ivan Head.

available through IDRC's Development Data Base Service.

The Brundtland collection consists of background papers, written submissions, tapes and transcripts of verbal testimony given at public hearings, official minutes and speeches and papers given by Mrs Brundtland. It comprises 43 volumes, 83 audio tapes, video tapes, and photographs.

Microfiche copies of individual documents may be obtained from IDRC free of charge.

IDRC also funded the duplication of documents for institutions in Hungary, India, Argentina, Kenya, and China. ■

Kathy Pendergast

People versus schistosomiasis

Health education and community involvement can be effective weapons in the battle against schistosomiasis, according to the preliminary results of a study conducted in Kenya's top rice-producing area.

Also known as bilharzia or "snail fever", schistosomiasis is a debilitating parasitic disease. It affects up to 70 percent of the residents of some villages in the Mwea Irrigation Scheme, about 100 kilometres northeast of Nairobi.

The main symptoms of the disease are fatigue, fever, diarrhea, blood in the urine, painful urination, and abdominal pain. Damage to the liver and spleen is cumulative.

Ironically, the slow-moving water in the irrigation canals that make this area so fertile is also an ideal breeding ground for snails in which the schistosome parasite lives half of its life. Since it lives the other half of its life in human beings, poor water use and sanitation practices have caused a constant cycle of infection and reinfection of villagers.

The researchers at Mwea are led by Melanie Katsivo, a medical sociologist with the Kenya Medical Research Institute (KEMRI). Her team is working with two groups of villages, using one as the control group and the other as the experimental group, that is, the area in which an intervention program is being carried out. (See *Reports*, July 1986, p. 8.)

With the help of KEMRI staff, villagers in the intervention communities built 11 handpump-operated shallow wells, plus laundry and bathing facilities at six of the sites. They also constructed 35 permanent pit latrines near the paddy fields, and instituted a vigorous health education program. Both the intervention and non-intervention populations were then given the drug praziquantel to bring down the schistosomiasis infection level to close to zero. The pattern of reinfection in the two villages was then observed.

According to a recent report by Ms Katsivo, the infection rate among 5-to-19-year-olds in the intervention villages, which was 91 percent before the program started, was only 41 percent one year after the drug

treatment. For the non-intervention villages — where there was no health education program and no improvements to water supply and sanitation facilities — the figure for the same age group during the same period actually rose from an initial 64 percent to 77 percent. The overall infection rate in the experimental communities fell from 81 to 53 percent. The rate in the control village fell only slightly from 61 to 57 percent.

Schistosomiasis awareness among household heads in the intervention village grew from 30 to 92 percent after health education. The number of people who associated infected snails with the disease grew from 3 to 38 percent. The use of latrines as a control measure increased sixfold and a majority recognized that general cleanliness interrupts the transmission cycle.

Trichogramma — the wonder wasp

A wasp small enough to fit on a pinhead is being used in China, the Soviet Union, the United States and, experimentally, in Canada to wipe out insect pests that harm crops.

Released at the peak of pregnancy, trichogramma wasps lay their eggs directly into the eggs of more than 400 insect species. The developing parasites consume the host egg, leaving the crops undamaged.

While Canadians have been aware of the wasp's destructive potential for 100 years, the Chinese have led the way in applying it in pest control over the past 50 years.

In China, the wasps are being used to fight two main insect pests: the Asian corn borer and the sugarcane stem borer.

The Chinese rear millions of wasps using large host eggs (specifically those of the oak silkworm moth). Unfortunately, this technology can be used with only three of the 19 trichogramma species found in China, thus limiting the potential of this highly effective biocontrol method. In Canada, however, scientists at the University of Guelph are developing a rearing system based on the use of small host eggs. It can be used for a larger number of trichogramma species.

In an attempt to increase the availability of trichogramma to small-scale farmers in China, IDRC is funding a joint research project between Guelph and the Biological Control Laboratory in Beijing, China. As well as testing the small-host-egg method, researchers are developing and testing new trichogramma strains.

Trichogramma are environmentally safer than chemical pesticides and, at a cost of CA\$15 to \$22 per hectare in China, about one-tenth the cost. The research will allow Chinese farmers to use the wasps on a wider range of vegetable and orchard pests.

The advantage of trichogramma is that, once applied, it does not itself become an agricultural pest. In fact, for this biocontrol technology to be effective, loads of trichogramma must be airdropped each year to target fields.

In Canadian tests, Trichogramma egg parasites were able to kill up to 80 percent of spruce budworm eggs in a Northern Ontario region, bringing the infestation under control.

Dr John Laing, of the University of Guelph, says several million wasps per hectare are needed to effectively wipe out insect pests in forested areas. Less than a million per hectare are needed in agricultural systems.

The passing of palms

Lethal yellowing (LY), a deadly disease that attacks palm trees, has turned many of Mexico's once tree-lined avenues and shaded beaches into bare roadways and sun-parched, shelterless expanses of sand.

The disease, caused by microorganisms and carried from tree to tree by insects called planthoppers, attacks mainly the Jamaican Tall variety of palm. It's a tree known not only for its majestic beauty but also for the millions of dollars it yields in coconut products.

Between 1984 and 1987, this "tropical vanishing act" all but wiped out the coconut palms on the Caribbean coastline of Isla Mujeres.

Randolph E. McCoy, a plant pathologist and expert on palm diseases in the Western Hemisphere, writes in the July 1988 issue of *National Geographic* magazine that it's only a

matter of time before LY, which can kill a tree five months after it strikes, affects the entire Gulf coast of Mexico, causing "incalculable damage to the coconut industry".

The disease can be treated by injecting the antibiotic tetracycline directly into the diseased tree every four months. But this treatment must be continued indefinitely if the tree is to survive, making it very expensive and impractical on large plantations with tens of thousands of trees.

Writes Dr McCoy, "Despite extreme measures such as quarantines and felling of threatened trees, millions of producing coconut palms will die before the epidemic runs its course."

Environmental refugees in Africa

So far this decade, desertification has pushed 10 million African "environmental refugees" from their farms to already overcrowded cities and refugee camps, according to this year's *State of World Population Report* from the UN Fund for Population Activities.

Some 65 million hectares of farm land in sub-Saharan Africa have been turned to desert over the last 50 years. And the process is accelerating. More than 20 million hectares of land become useless every year.

When drought comes, small-scale farmers, who are already overworking their tiny plots of land, find themselves literally forced off their farms. They have no incentive and no surplus cash to invest in soil conservation, fertilizers, better seeds or machinery. The land has no time to regenerate.

Desertification currently threatens about one-third of the world's land surface and the livelihoods of at least 850 million people. By the year 2000, 75 percent of Latin America's population, 42 percent of Africa's and 37 percent of Asia's will live in cities, many of them because of increasing competition for dwindling arable land. But according to the Report, there are ways to save the land.

"Slower growth and more even distribution of population would help to take pressure off agricultural land, energy sources, vital watersheds and

forest areas." The loss of productive land can be reversed through increased and more effective cooperation between industrialized and developing countries.

The earth is capable of supporting the increasing needs of the next century, depending on the choices made and the policies adopted, the Report says. "As individuals or as nations, there is no escaping our responsibility. We share a common future."

Worldwatch on deforestation

Land clearing, fuelwood gathering, commercial timber harvesting, and cattle ranching have caused the earth's forests to shrink to 4.1 billion hectares. That's a third less than the 6.2 billion hectares that existed 10 000 years ago in pre-agricultural times.

Deforestation — the subject of a recent Worldwatch Institute publication, *Reforesting the Earth* — is driven by such powerful forces that current replanting efforts are inadequate. Actual establishment of fuel plantations has averaged about 519 000 hectares, less than a fifth of what is needed.

For the roughly 2.5 billion Third World inhabitants who rely on gathered wood to cook their meals and heat their homes, lack of wood translates into reduced living standards and, in some cases, directly into malnutrition.

Authors Sandra Postel and Lori Heise write that because of overworked and depleted soils, peasants must clear more forest to survive. But forests play a vital role in ecological functions such as soil stabilization, nutrient conservation and moderated water supplies. As well, a continued rise in carbon dioxide levels caused by deforestation, along with concentrations of other gases, threatens the world with potentially catastrophic climate shifts.

The authors believe the key to mobilising villagers in the battle against wood scarcity is to promote the growing of trees that meet their needs while also increasing the amount of wood available for fuel.

A focused effort on breeding multipurpose trees that endure droughts and grow well in marginal environments could greatly improve prospects, write the authors.

And, with the human touch, reforest-

ing the earth may be possible. "Covering the equivalent of 130 million hectares with forest by the year 2000 would entail successfully establishing some 18.4 billion trees annually. It would require each person now living in the Third World to plant and care for five seedlings a year."

For more information write to: Worldwatch Institute
Paper No. 83
1776 Massachusetts Avenue NW,
Washington, D.C. 20036
U.S.A.

Mugabe honoured for role in Zimbabwe's agriculture

Robert Mugabe, the president of Zimbabwe, has won the 1988 Africa Prize for Leadership for the Sustainable End of Hunger.

The international jury selected Mr



Photo: Min. of Information, Zimbabwe

Mugabe to receive the US\$100 000 prize because he has established policies that have made Zimbabwe's agricultural system one of the most impressive in Africa. Under his leadership, small-scale Zimbabwean farmers have seen a dramatic improvement in their access to credit and their crop revenues have increased 10-fold, said Bradford Morse, chairman of the selection committee. Women, who do two-thirds of all farm work in Zimbabwe, now have access to farmland, credit, and agricultural training.

The Africa Prize is awarded annually by the Hunger Project, an international nonprofit organization committed to ending the persistence of hunger. The prize aims to recognize the contributions of individuals in sectors such as public policy, science, agriculture, education, and health, and whose leadership and

policies reflect courage, initiative, creativity, boldness, and in some cases, personal sacrifice.

The cash award is given in support of the recipient's continuing work on behalf of Africans.

Writing research papers

"Few scientists find writing scientific papers easy," says a handbook aimed at helping those whose first language isn't English to write research papers in that language.

"The majority of scientists in the developed world can publish in journals in their own languages, such as English, French or German. Most developing-country scientists have no such advantage. For many would-be contributors these languages are not their native tongue, so writing scientific papers becomes very much harder."

Writing Research Papers: An Easy Guide for Non-Native-English Speakers, is published by the Australian Centre for International Agricultural Research (ACIAR). Its author, Paul Stapleton, was the first managing editor of the *Indonesian Journal of Crop Science* and based the guide on material he prepared for a writing course for Indonesian scientists.

Consistent with its own message, *Writing Research Papers* is logically organized, easy to read, and, at 47 pages, quite compact. It covers all stages in the preparation of a journal research paper — from questioning whether the research is significant enough to publish in the first place, to organizing and writing the various components (title, abstract, results, tables, figures, and references), to packaging the material for the post.

When writing the first draft, advises the author, "you should write as fast as you can. Do not worry about language, grammar, style or spelling. Just write down as much as possible while the flow of whatever section you are working on is clear in your mind. . . This first draft can be as untidy as you like. Only you will see it."

On completion of the second draft, "give the article to friends or other workers in the same field as yourself and ask them to comment on the scientific content for you, pointing out errors of logic and in-

terpretation, noting where your writing is clumsy, and recommending further improvements."

The last few pages provide useful style tips such as use of the passive voice and abbreviations, and the need to avoid long sentences.

For copies of *Writing Research Papers*, write to:
ACIAR
GPO Box 1571
Canberra ACT 2601, Australia

The literature on cities

The Annotated Bibliography and Guide to the Literature on Small and Intermediate Urban Centres in the Third World covers 170 published works. It allows the reader to easily identify and grasp the scope and conclusions of original works found in journals not widely used by urban researchers.

The bibliography, which draws on a literature review of 53 journals, includes annotations for some lesser known, limited-distribution Third World literature. Annotations are divided into areas such as: economic and social organization, political structure, social stratification and social mobility, migration, and settlement trends.

Realizing English is not the first language of many potential readers, the authors wrote the annotations in easily understood language and included annotations for works in English, Spanish, French, and Portuguese.

The bibliography is one of a series of publications arising from collaborative research by a network of Third World institutions and coordinated by the Human Settlements Programme of the International Institute for Environment and Development (IIED).

The price (including postage and packing) is \$10 US for Third World orders and \$15 US for all others. Write to:
IIED Human Settlements Programme
3 Endsleigh Street
London, England WC1H 0DD

The "In Brief" section was researched and written by Kathy Pendergast. She is a recent graduate of the Carleton University School of Journalism and served as editorial assistant to Reports last summer.

IDRC annual report

The IDRC Annual Report for 1987/1988 includes divisional summaries, financial statements, descriptions of new projects and lists of IDRC award winners and publications.

Almost 70 percent of the Centre's \$112.4 million budget was allocated to development research and related activities.

The 93-page publication is available from the Communications Division at IDRC headquarters in Ottawa.

Research issues in child health and child care: proceedings of a workshop held in Accra, Ghana, 22-26 September 1986

Editor: Fiona MacKenzie
IDRC-266e, 148 pp.

This publication, the result of a 1986 workshop on infant and child health and mortality, aims to promote further communication and interaction among researchers working in this area.

The workshop brought together health and social scientists from the Gambia, Ghana, Nigeria, and Sierra Leone to discuss child health and mortality issues and to identify new research needs.

The participants emphasized evaluation of research design and analytical procedures.

Applying to IDRC for agricultural research funds

This is a series of five booklets aimed at researchers and research institutions intending to make a proposal to IDRC for project funding. It outlines the role and scope of research eligible for support from IDRC's Agriculture, Food and Nutrition Sciences (AFNS) Division.

The booklets cover the five sub-programs of AFNS: post-production systems, agricultural economics, forestry, crop and animal production, and fisheries. They outline program strategies and discuss target populations, institutional requirements, project selection criteria, and research needs and future directions.

Improving young child feeding in eastern and southern Africa — household-level food technologies: proceedings of a workshop, Nairobi, Kenya. 12-16 October 1987.

Editors: D. Alnwick, S. Moses, O.G. Schmidt
IDRC-265e, 678 pp.

As young children in developing countries are weaned off their mother's breast milk, they are at great risk nutritionally. Their nutrient intake is low and weaning foods are often contaminated, causing diarrheal disease.

Combined with a decrease in the duration and intensity of breast feeding, these factors lead to the chronic malnutrition of one-third of eastern and southern African children by the end of the second year of life.

This publication presents the proceedings, conclusions, and recommendations of an international workshop attended by African and South Asian food scientists, nutritionists, and health planners.

Participants examined household-level technologies that hold promise for improving infant nutrition and discussed topics such as the use of fermented foods and germinated flour to improve nutrient intake and decrease the risk of food contamination.

The publication is directed at health planners involved in developing programs to improve feeding of infants and young children in developing countries.

Reservoir Fishery Management and Development in Asia: Proceedings of a workshop held in Kathmandu, Nepal, 23-28 November 1987

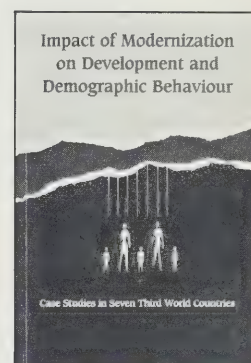
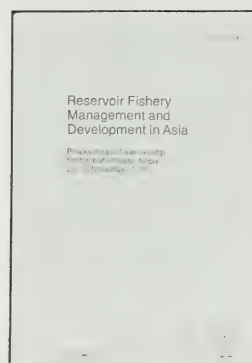
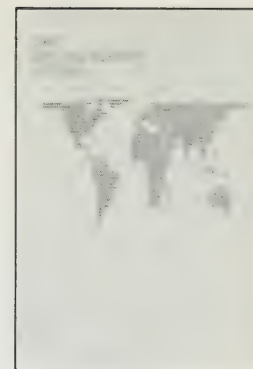
IDRC-264e, 246 pp.
Editor: Sena S. De Silva

Reservoirs are one of the few new sources of potential fish production in the world. In Asia, although reservoir construction is increasing rapidly, there is limited knowledge on which to base planning and development decisions.

Because reservoir fisheries are a relatively new phenomenon in Asia, scientists working on the reservoirs were anxious to meet and exchange research results and discuss future strategies for research and development.

This publication is the proceedings of an IDRC-sponsored workshop held in Kathmandu, Nepal, 23-28 November 1987. It includes papers on: existing fisheries; biological, resource, and management aspects; and general recommendations.

The participants, from 15 countries, emphasized the potential for increased fish production in reservoirs and the need for early involvement of fisheries scientists in dam construction projects.



Impact of Modernization on Development and Demographic Behaviour: Case Studies in Seven Third World Countries

Editors: Barkat-e-Khuda and Carol Vlassoff
IDRC-260e, 123 pp.

How has development affected the behaviour of populations in the developing world? Are fertility rates higher or lower as a result of development efforts? Has the pattern of human migration changed? Have mortality rates decreased?

Over the past decade, demographers and policymakers have been asking — and answering — a host of such questions crucial to the quality of life in developing countries.

This book presents original and much needed household-level data on the link between development and demographic behaviour. It analyzes, interprets, and synthesizes IDRC-funded, long-term projects in seven Asian and Latin American countries: the Philippines, Malaysia, Bangladesh, India, Colombia, Argentina, and Peru. A concluding chapter pulls together insights common to the seven studies.

Le sucre Menace ou défi ?

Évaluation de l'incidence du
développement technologique
dans les industries des
produits surochimiques et du sirop
de glucose à haute teneur
en fructose

Clive Y. Thomas



Metodología de Investigación en Sistemas de Cultivo en Finca



Small-Scale Fisheries in Asia: Socioeconomic Analysis and Policy



Editor: Theodore Panayotou

In addition to *Reports* magazine, IDRC also publishes scientific monographs, technical reports, and general interest materials on the role of research in international development. A catalogue of current publications is available from the nearest IDRC office (see page 3 for complete addresses).

Publications may be ordered from the following IDRC sales agents:

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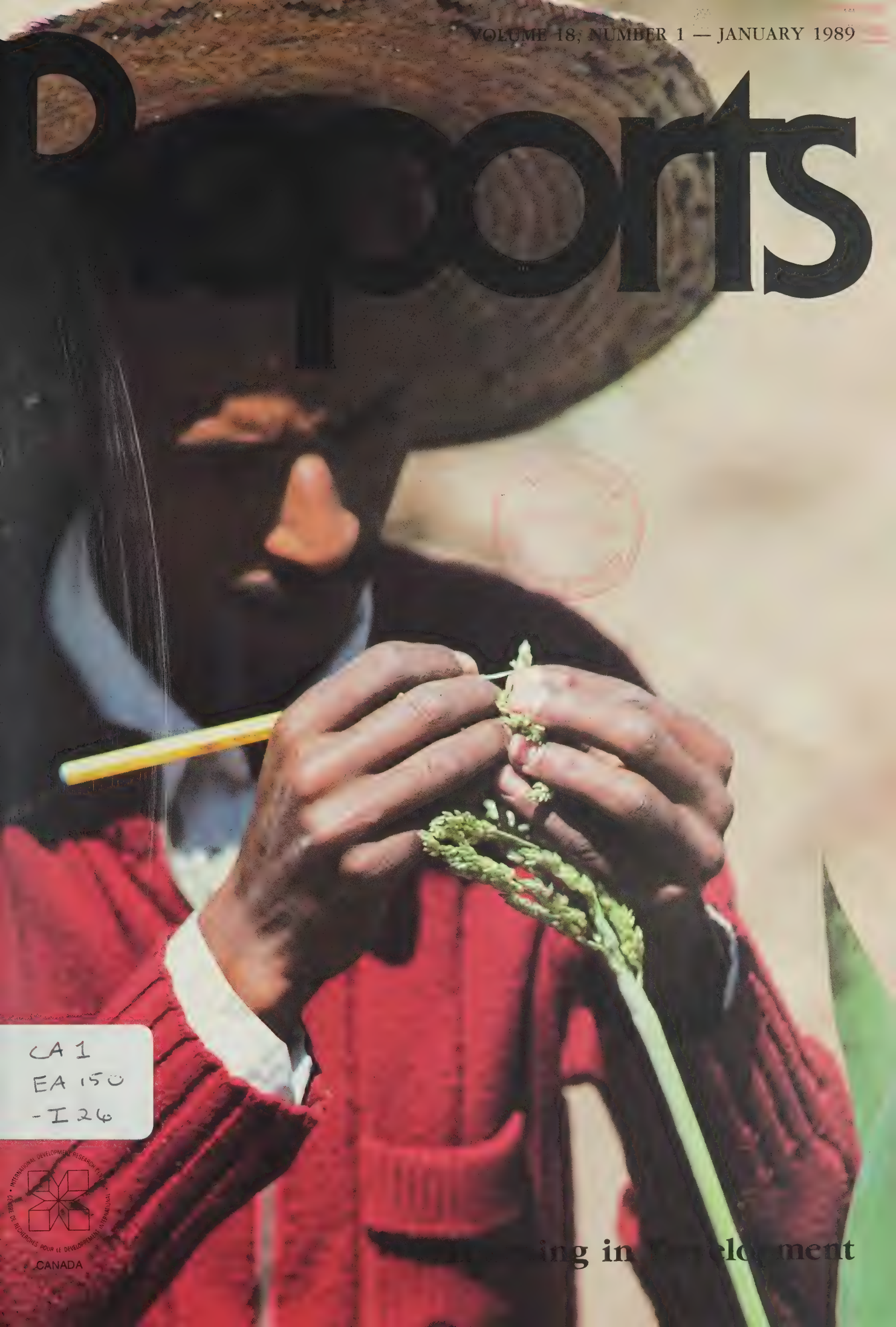
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VOLUME 18, NUMBER 1 — JANUARY 1989



Dports

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CANADA

ing in development

Writing on several levels

Any information or message involves presumptions which are not explicit. That is something which sometimes comes up when a Westerner who hasn't any direct experience of Africa tries to find answers to the "African crisis," which, I suppose, can't help but differ a little from the "Asian crisis".

It also happens quite often when an African intellectual who lives by trailing a ball point pen over paper, speaks — particularly if it is someone who has cut their links with their native village.

That's why I suggest that the "North" ought also to be concerned with a more generalised, sensitive, integrated, practical type of information, better adapted to the ways of ordinary Africans who don't have the advantage of having small-scale "examples" as the ordinary people of Asia do.

By way of example, your issue on "Designing Better Fish" (*The IDRC Reports*, January 1988) should have been prefaced by an article to make it accessible to African readers. This article could have talked about what aquaculture is and how it works, described simple methods which could be used by families to achieve self-sufficiency in food production, and ended with comments about more advanced methods.

Generally speaking, you should ask the writer of scientific articles to write in such a way that an article can be understood on two levels, even three or four levels, so that everyone can find something they can understand and which is worth their attention. That would give the writers useful practice and could serve as a criterion of excellence.

Doctor Nyouma Alexandre
Chief Doctor
Yoko Hospital
Cameroun

Loose fish

I read your articles on aquaculture (*Reports*, January 1988) with great interest. They give a clear description of the research taking place to try and improve production of captive fish by using selection studies.

I would like to point out the major problem with intensive aquaculture in Western Colombia seems to be that the researchers don't know how to handle the species they are working with. One of the reasons several projects have failed is because of the uncontrolled reproduction of unsexed tilapia in tanks, which leads to degeneration.

Another very disturbing factor is the poor planning when tanks are set up. They overflow during the rainy season and carry off exotic voracious species such as the *Tucunare* into natural water courses such as the San Juan and Vieja rivers where they decimate the indigenous fish.

Epifanio Marin Rios
Forester
Pereira, Colombia

Rural schools need real support

Denis Marchand's brief article — "Classrooms, Crops and Crafts" (*Reports*, April 1988) — about the program begun in Mali in 1968 to ruralize schools shows no awareness of similar attempts in other parts of the world for over a century. Such attempts usually succeed for a decade or two because traditional schooling is not possible in a limited geographical area due to insurgency (e.g. Yenan in China in the 1930s) or because in relatively stable societies, one or two schools in a few districts are carefully selected to link crops and crafts to school curricula (e.g. Wardha in India in the 1930s).

In both cases, the genuine — not merely rhetorical — support of political and educational leaders is a *sine qua non*: to provide enough money

for low teacher-pupil ratios and equipment, and to ensure sufficient autonomy for the school staff to try out innovative curricula and teaching methods. Other essential conditions include dedicated and imaginative teachers as well as community support (or at least non-interference).

Nation-wide efforts to make schools — especially in rural areas — more vocationally relevant through the introduction of a manual labour component in the curriculum have, without exception, failed until now. Many of the reasons — unavailability of good curriculum materials — are internal to the educational system. Other, more important reasons arise from people's perceptions about the role of the school in promoting individual occupational and social advancement or decline. (These reasons are discussed in my article "Continuity between School Curriculum and Vocation: Manual Labour's Ineffective Role" in *International Review of Education*, XXXIV (1988), 207-233.)

Will Mali's experience be different? The evaluation mentioned in Marchand's article being conducted by the Institut de Pédagogie Nationale would be of great interest to policymakers when completed.

Mathew Zachariah
Professor of International
Development Education
University of Calgary

Guinea pigs galore!

I read with great interest Robert Charbonneau's article on raising guinea pigs in Peru (*Reports*, July 1988). I work in a small village in Northern Peru called Zaña. There, we have a Women's Centre where we try to encourage small income-generating activities. Many people in Zaña raise guinea pigs. The Centre has also tried to raise guinea pigs but we switched to rabbits because we didn't know how to get large guinea pigs (the local breeds are very small).

Could you put me in touch with the research team so they could help us set up a farm to raise guinea pigs in Zaña? We need to improve the local breed and we need information and technical assistance.

Sister Antonia Stafford
Sisters of San José
Chiclayo, Peru

The researchers can be contacted at this address:

Lilia Chauca or Marco Zaldivar
Estacion experimental
La Molina
Apartado 2791
Lima 100
Peru

Your feedback is appreciated

Reports welcomes letters of comment and information from readers. If you're engaged in development work similar to the projects described in the magazine, let us know — other readers may be interested. Or, if you wish to take issue with an article or clarify certain points, drop us a line. Letters should not exceed 250 words and are normally edited.

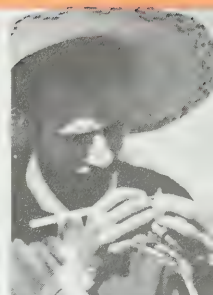
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Editor's note:

The associate editor for this issue of *The IDRC Reports* is Ania Wasilewski, a writer/editor at IDRC. Most of the articles for our theme on human resource development were researched and written by Edward Israel, a student at the Carleton University School of Journalism in Ottawa, Canada.

Every day thousands of researchers are working on development issues around the world.
Photo: Clyde Sanger.



Reports

THE IDRC

The IDRC Reports is published quarterly by the International Development Research Centre (IDRC) of Canada. Its aim is to keep an international readership informed about the work IDRC supports in developing countries, as well as other development issues of interest. The magazine is also available in French as *Le CRDI Explore* and in Spanish as *El CIID Informa*.

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CONTENTS

Letters

2

OUR THEME THIS ISSUE: LEARNING IN DEVELOPMENT

Opening the doors

4

Training researchers in development opens the doors to better lives.
By Paz Buttedahl.

Listening and learning

6

A Peruvian mayor's obsession changes the lives of a shantytown's citizens.
By Wilson Ruiz.

A mix of magic and the mundane

8

A Young Canadian Researcher's diary from the jungles of Papua New Guinea.
By Edward Israel.

Beyond reading: Understanding

11

Beshah Girma discovers Ethiopian mothers can't understand the instructions on oral rehydration packets.

Teaching teachers

11

Patricia Ellis finds adult educators in the Caribbean aren't trained to teach adults.

A sweeter combination

12

Noël Govinden perfects intercropping of maize and sugar cane in Mauritius.

Building the South-South connection

13

The Chinese get down to business — training scientists from developing countries in mariculture. By Edward Israel.

A land scarred by erosion

14

Swaziland is in danger of becoming a mountainous desert. By Denis Marchand.

Losing a way of life

16

Desertification is forcing Mali's nomads to settle. By Colleen Thorpe.

A looming revolution in Pakistan

18

A new invention frees Pakistani weavers from importing expensive equipment.
By Robert Charbonneau.

Valley of the blind

20

Researchers discover why 7000 Zambians living in the Luapula Valley are blind.
By Daniel Lubinga.

Better results in the field

22

Farmers in Egypt are breeding their own sheep and getting better results than the researchers. By Robert Charbonneau.

Commentary

24

Squatter settlements are not a problem but a solution to the problem of housing. Decision-makers must recognize the self-help efforts of squatters. By Meera Bapat.

Briefs

26

News and trends in international development

New releases from IDRC

27

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Photo: N. McKee

OPENING THE DOORS

Is learning the key to development? More and more people are beginning to realize that the training of individuals is a vital component. Without the skills, energies and knowledge of human beings, development is impossible. Human resource development (HRD), has recently become an acknowledged and official strategy for Canadian agencies such as IDRC and CIDA.

This issue of IDRC REPORTS looks at how the meaning of human resource development has changed in the past two decades and what it means today. It describes how funding Third World researchers to pursue graduate programs can lead to measurable progress. It tracks down a Peruvian who received a Canadian graduate degree almost ten years ago and is now the leader of a thriving Lima shantytown that serves as a model for urban organization in developing countries. It also looks at the harrowing adventures of a Young Canadian Researcher, an IDRC scholarship winner, in Papua New Guinea. And it reports on the increasing scientific cooperation between developing countries by looking at an aquaculture research and training project begun by China and Canada and now spreading to other countries in the South.



Photo: D. Sing

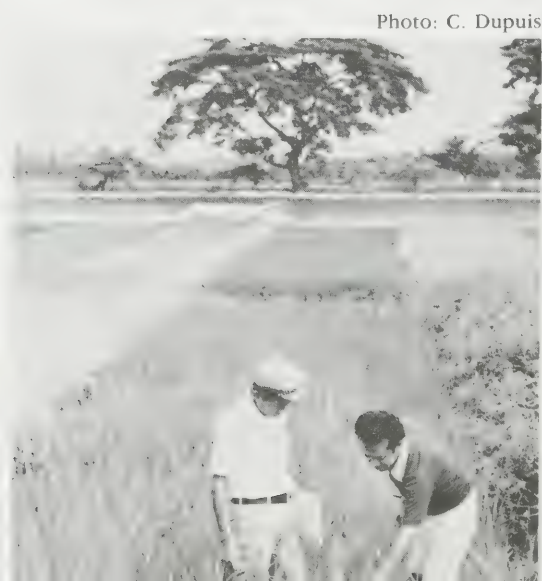


Photo: C. Dupuis

THE LEARNING PARTNERSHIP

PAZ BUTTEDAHL

Give a man a fish and he will eat one day. Teach him how to raise fish and he will be able to eat every day." Ancient Chinese saying.

In recent years, human resource development has become the underlying concept driving Canadian foreign aid. The Winegard Commission, a 1987 Canadian Parliamentary Task Force established to review Canada's overseas assistance policies, reported Canada should focus on human rights and human resource development as the centre of its development assistance programs.

There has always been an emphasis on education and training in development programs but the reasons and the methods have continuously changed. In the 1960s, most development aid shifted from education and training to capital assistance for strengthening physical infrastructures. This occurred partly because the management of training programs was very labour-intensive but also because development priorities were changing. At the same time, "human capital theory", the notion of investing in people was presented as an economic alternative to investing in infrastructure.

In the late 1970s attention focused on food and basic aid to help the health and welfare of "the poorest of the poor". But development agencies discovered it wasn't easy to find starting points for these types of development projects because of a lack of trained people. So, in the 1980s the emphasis moved from infrastructure back to people as the world became aware of the complexities and interdependence of economic growth, and the limitations of knowledge to tackle new development problems. However, the definition of human resource development also changed — it was no longer seen as a sector standing by itself but as an integral part of the entire development process.

Today, HRD is defined as "the development of individual, group and institutional capacities for self-sustained learning, generation of technology, or implementation of development activities". Human resource development can be seen as a prism through which all aid activities can be viewed.

What one sees is that in today's world over one-third of humanity is living in poverty. Famine is still a fact of life for millions of people. One out of four inhabitants of the globe is illiterate. Over 400 million are underemployed or unemployed. These are the indicators which measure a country's state of development, along with health, housing and access to education.

Although the industrialized world has only 20 percent of the world's population, it accounts for 85 percent of world-wide expenditure on education and 95 percent of expenditure on research. These proportions are even more glaring when

one takes into account the fact that over one-third of the world's population is under 15 years of age, and 90 percent of them live in the Third World.

Human resource development is the process of improving human capabilities to raise the standard of living to an acceptable level. Human resource development is no longer restricted to the school system, and formal and informal training programs — it also includes technological inputs, material support, and on-the-job training to develop skills and increase productivity.

It involves direct assistance to education and training institutions, and to social development activities such as training for better health and nutrition. As HRD consultant Donald Simpson writes: "It is no longer simply enough to build a school, pay for a teacher or offer a fellowship." Developing human potential also means developing relationships over the long-term, as well as institution-building. And it means working in new areas besides agriculture, education and health — such as energy, trade, marketing, industrialization, financial management and monetary policy, informatics and computerization, small-scale private enterprise and the environment.

Even though it is now widely recognized that the human element is at the core of all development efforts, governments may have a difficult time putting human resource development into practice.

Sylvain Lourie, a past director of the International Institute of Educational Planning, notes that "experience has taught us that while most governments pay lip-service to the *human element*, their simultaneous obligation to meet military, production trade and financial objectives leads them to take actions which do not necessarily reflect social and cultural imperatives."

A quick glance at expenditure statistics confirms Lourie's observation. China spent 6.7 percent of its total expenditures in 1979 on its military. During the same year, only 3.3 percent of expenditures went towards education. In Pakistan there are 429 military men for every 265 teachers. And for every 12 doctors in Indonesia there are 239 soldiers.

No matter what the statistics reveal the reality is that when governments have to apply structural adjustment policies, the sectors first cut are those dealing with social services, of which education and training are a part.

How are development agencies responding? With a growth in fellowships, scholarships and most importantly training components for projects. At IDRC, 20 percent of all projects in 1971 had a training component; in 1982, 42 percent of projects had training components.

IDRC's support of HRD is deeply rooted in the philosophy of a learning partnership. IDRC staff and recipients *acquire*

knowledge through training and experience, *generate* knowledge through research, *share* knowledge through information dissemination, and *apply* knowledge in the utilization of research results. In the past many development agencies have focused on training individuals as individuals, a high-risk approach benefitting the individual and making him or her more upwardly mobile and perhaps less inclined to stay in their home country and work in development. The approach being used now is one of "capacity building" or of training researchers who are attached to institutions and thus strengthening the research capacity of the institution or community. This wider training effort provides research skills to a broader community, one capable of constituting a critical mass that can accumulate, reproduce and create new knowledge for institutional development purposes. The ultimate purpose of capacity building is to ensure "sustainable development".

These types of training activities may range from scholarships to pursue Masters and Doctoral degrees, to support for group training activities, to curriculum development, to research on needs assessments, training methodologies, and manpower requirements, and under certain circumstances to scholarly exchanges.

Learning is an integral part of human development, and culture and learning are inextricably linked. Each society and culture has different and distinct ways of learning. Emphasis must be placed on the design of learning experiences. Both individual and group training activities must be tailored to the participants needs. The role of development agents is to catalyze and facilitate "learning partnerships" where knowledge is shared equally.

As well, mechanisms to transfer and reproduce newly acquired knowledge and skills must be developed. Training activities should take place primarily within local, national and regional boundaries to benefit those directly concerned with the results of the training and research. The ultimate goal of human resource development is to strengthen indigenous capabilities to do development work and development-related research.

Human resource development has evolved a great deal since the Chinese coined their proverb. "Teach him how to raise fish" was the human resource development answer to raise standards of living and quality of life centuries ago. Today, the situation is more complex. In most cases those who learned to raise modern-day fish have achieved a decent standard of life, but those who haven't remain poor and illiterate and underappreciated. ■

Dr Paz Buttedahl is the deputy director of IDRC's Fellowships and Awards Division. Some of the information in this article is from Entrepreneurs in Education, a study by Donald Simpson for IDRC.

LISTENING AND LEARNING:

AN INTERVIEW WITH THE MAYOR OF A PERUVIAN SHANTYTOWN



Photos: W. Ruiz

WILSON RUIZ

Michel Azcueta, mayor of the district of *Villa El Salvador* — 10 kilometres from Lima's main square — arrives at the municipal building to the warm greetings of dozens of women. He shakes hands with as many as possible and seems to know them all by name. As he makes his way to his office he stops to talk with a toothless woman trailing two small children by the hand. "The economic crisis here in Peru has affected mainly the poor," Mayor Azcueta says.

One of the municipality's social workers, Rosaria Ledesma, grabs the mayor by the arm and drags him away to an improvised meeting with a group of

visiting social work students from Lima's San Marcos University. The older women grin and say it is important to wait for Michel, and they go on chatting among themselves. They are members of a cheese production cooperative established by Mr Azcueta in 1984, when he was first elected mayor.

Born in Madrid, Spain, Mr Azcueta moved to Peru in 1965 to attend the Catholic University in Lima. In May 1971, the same year he graduated as a high school teacher, a group of families made homeless by an earthquake invaded a vacant lot owned by the state in Pamplona, a working class district not far from downtown Lima, and demanded "a human right to a roof over our heads". After several

people were wounded and one killed by police trying to evict them, the government granted the invaders of Pamplona ownership rights over 12 square kilometres of desert land in the barren Andean foothills which surround Lima.

Over 500 families took possession of the land and named the new settlement *Villa El Salvador* — *Village of the Saviour*. By the end of the month, some 90 000 people had settled into the new shantytown. It was the biggest urban mobilization in the history of Peru.

One month later, Michel Azcueta and 15 other recently graduated teachers from the Catholic University arrived in *Villa El Salvador* to implement a revolutionary educational plan. "Our objective was to adapt the educational system to the Peruvian social reality and open the schools to the community," recalls Mr Azcueta.

His decision to participate in this educational reform project was based on his belief that education is the most effective agent for development. In the past 17 years, Mr Azcueta has personally established 18 of the 34 schools built by the community in *Villa El Salvador*. Today 80 000 students attend school in the district and pre-school children can go to any of the 150 kindergartens also set up through communal efforts.

The results of this educational push speak for themselves. Illiteracy has been practically eradicated. *Villa El Salvador* has an illiteracy rate of 2 percent, compared to a national rate of 27 percent. Over 56 percent of its residents are high school graduates, while the average for Peru is 8 percent.

"Michel's obsession with education has been the engine for the development of *Villa El Salvador*," says Jaime Seta, a member of the district's municipal council and Mr Azcueta's former pupil.

Mr Azcueta is standing by the door of the district's communications centre — which he set up in 1976 — and naming all the people in the room, when he is called over by the director and shown a chair at the front of the room. The mayor says he just wants to listen, and not once during the

Left, Michel Azcueta, mayor of Villa El Salvador with his student, Jaime Seta, now a municipal counsellor. Right, recently-built squatter homes invade the sand dunes like wild mushrooms.



course of the meeting does he speak.

He explains that his role is mainly supportive. Whenever morale is low he participates in discussions of dozens of community groups in *Villa El Salvador* but only to deliver one of his passionate pep talks. "You can always count on me, but the challenge is for you and the future of your children," he tells his neighbours. He then sits at the back of the room and listens. He says as mayor he must stress participation and not paternalism. He sees the 350 000 residents of his district as the key element in any development project. They take responsibility and ultimately, control.

"It definitely helped me to become a better planner."

Mr Azcueta's philosophy of development is the development of people and not of buildings and roads. He believes that development should not be measured by the number of high-rise buildings, but by the degree to which people have improved their standard of living.

In 1980, while still a geography and history teacher at the *Centro Educativo Comunal* (Communal Educational Centre), he received an IDRC Pearson Fellowship to attend the *Université de Montréal*. He arrived in Canada in October 1980 and nine months later completed a master's degree in education and communications — a task which generally takes two years. Despite the nonstop pressures of being a full-time student, Mr Azcueta devoted as many days as he could to travel across Canada visiting government agencies, research centres and universities to find out how Canadians run their institutions. "It definitely helped me to become a better

planner," he says. Ready to seize any opportunity that can give his community an advantage, he says his experience in Canada allowed him to evaluate his work in *Villa El Salvador* and to improve his organizational skills.

On his return to Peru in June 1981, Mr Azcueta proposed an ambitious job creation project to the district's Communal Council (CUAVES). Few families in *Villa El Salvador* have a regular source of income. The district is replete with stories of intermittent employment and long periods of joblessness. They are brought on by the economic recession generated by Peru's US \$13 billion foreign debt or the simple coldness of a national economy whose international competitiveness depends on its ability to pay low wages and ignore workers' benefits.

Seven years later, Mr Azcueta's job creation plan is a reality. The dusty piece of land, where in 1985 Pope John Paul II delivered his stirring message of hope to the youth of Latin America's largest shantytown, is now the site of *Villa El Salvador's* industrial park. With an initial fund of US \$400 000 apportioned by President Alan Garcia, more than a dozen small workshops have already begun production. Once completed, the community-administered project is expected to create 4000 full-time jobs and indirectly employ more than 15 000 people. Seven hundred small workshops, owned by the community or by the cooperatives set up by residents of the district, will produce a great variety of products including leather clothing, plastic bags and toys. Income from a 5 percent tax collected from these small businesses will be deposited into a Community Development Fund and used for the construction and maintenance of basic services in the district.

"In *Villa El Salvador* we are proving that communal participation is the key to development," says Mr Azcueta. He says that cooperation and solidarity are part of the indigenous heritage of *Villa El Salvador's* citizens. Even though almost five centuries have passed since the Spaniards conquered Peru, Mr Azcueta says

the indigenous people still have an ethnic identity and unity that allowed them to convert a patch of desert land into the thriving community of *Villa El Salvador* in just 17 years.

Back at the municipal building, women from the cheese production cooperative file out of their meeting room and approach Mayor Azcueta with detailed reports of their daily struggle to survive. "Our goal is to work together to improve our lives," one woman says, stretching her neck in a vain effort to look the mayor straight in the eye.

Mr Azcueta accompanies the women to Solidarity Square, and from the top of a pyramid built to commemorate the founding of *Villa El Salvador*, he points to the shantytown of 80 square kilometres which clings to the slopes of the sandy mountains like a wild mushroom. In the distance, mixed with swirls of dust from the unpaved streets, the members of the cheese cooperative can be seen hurrying home. "As the Mayor, I am the image of *Villa El Salvador*, but in reality I'm just one more resident with the same obligations and rights as anyone else," says Mr Azcueta.

The difference between Mayor Azcueta's program in *Villa El Salvador* and those undertaken in other Peruvian municipalities is his emphasis on the consolidation of community-based organizations. "We encourage community leaders and residents to assume responsibility for their own development. That people should be responsible for their own destinies is only morally correct," he says. The suggestion that this sort of idealism could be carried too far and that by teaching the poor to take charge of their own lives he is probably changing the status quo, makes him pause and lean forward. Looking at the children playing in Solidarity Square, he explains that he is not changing the national situation, just planting the seeds of change in *Villa El Salvador*. ■

Wilson Ruiz is a Canadian freelance writer and broadcaster, based in Lima, Peru. He specializes in Latin American affairs.

A MIX OF MAGIC AND THE MUNDANE: A RESEARCHER'S NOTEBOOK



Photos: R. Vallance

EDWARD ISRAEL

When Elizabeth Vallance, 29, travelled to Papua New Guinea to conduct research for her Ph.D. thesis, she knew she was going to what travel brochures call "the land of the unexpected". In September 1987, armed with tools for measuring nutrition levels, a portable micro-computer, a Young Canadian Researchers award (see box) from IDRC and the enthusiasm of an explorer, the anthropology student from Hamilton's McMaster University, and her husband, Richard, departed for the vast Pacific island off Australia's northeast coast.

Ms Vallance wanted to determine whether there is a change in nutritional sta-

tus among mothers and their children who move to urban areas of Papua New Guinea. She found that those whose income is higher are markedly fatter than their rural counterparts and more susceptible to obesity-related diseases such as diabetes and hypertension. What she didn't expect to encounter during her eight-month stay were the logistical nightmares of contracting malaria, getting robbed, nearly capsizing in the Bismarck Sea and dancing to beating drums at all-night "sing sings".

In her quarterly progress reports to IDRC she described the rigours of modern research in the land of the unexpected. In this excerpt, Ms Vallance and her husband are travelling to Kandoka, a small village on the northwest coast of the province of New Britain.

"The trip to Kandoka took three days — three days in a 10 m government boat without cabins or toilets. It was supposed to take 12 hours, but they forgot to mention our stop at Bali Vitu, an island off the northwest coast. We slept on the boat with the other 35 passengers sprawled wherever. We drank a little water, ate dry biscuits and the next morning took a bathroom break at the Catholic sisters' home on Bali Vitu. Back on the boat, they took us through heavy seas to the port of Cape Gloucester at the western tip of New Britain. We arrived at dusk and slept on the boat. My husband and I shared a bunk in a tiny cabin with four crew."

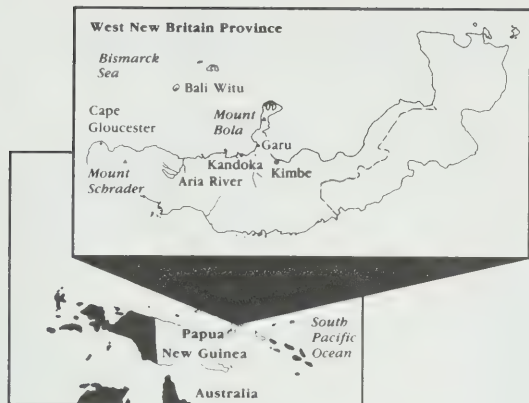
"In the morning the crew assured me I would see Kandoka by noon, but by 3 p.m. we spotted a storm ahead and stopped at Aramigi, a small island. We were tired, dirty, hungry and dehydrated — and of course we arrived the evening of an all-night traditional sing sing."

"It was, through my glazed, tired eyes, a queer mix of magic and the mundane. It went on and on and involved the Tumbuan, a large grass-covered, long-headed creature and his leaner, two-headed mother. Both characters hopped around a group of singers and drummers most of the night."

The next day they arrived in Kandoka for a three-month stay. After settling into a bamboo house on stilts, Ms Vallance mapped the village, hired an assistant and sampled 115 villagers. She surveyed their reproductive histories, measured and weighed them, noted what they recalled eating in the last 24 hours and took samples of their hair to measure zinc concentration — an element considered essential for normal growth, appetite and sense of taste.

"The work is progressing well and I can converse pretty fluently in Tok Pisin (Melanesian Pidgin). I have given children 400 balloons in exchange for food samples from them. At one point I had 35 mangoes, 16 drinking coconuts, 8 pineapples, pounds of kau kau (sweet potato) and bundles of abika, a leafy green vegetable." (Editor's note: These foods are abundant and accessible but make for a diet with little protein.)

"I have collected data from 43 households in Kandoka, focusing on parents and their children 5 years-old and under. Children 4 months-old to 3 years-old



Left, Elizabeth Vallance on the dock at Cape Gloucester. Right, measuring a woman's arm circumference to determine her nutritional status.



suffer the most serious nutrition problems. During those years children lose ground in weight and height relative to age. This stunting is thought to be related to the late introduction of solid foods or foods which cause diarrhea and dehydration. It is suggested that the children suffer neglect, that mothers just don't feed them. But this doesn't seem to be the case since both mothers and children have little protein available to them. I can say with certainty that men eat far more protein."

Ms Vallance discovered the villagers' nutritional problems don't lie in the supply of food — for food with protein is readily available — but instead in the traditional unequal distribution of food amongst family members. She discovered women and children are simply not consuming nutritional foods. After collecting data in Kandoka the Vallances departed for Kimbe, the island's most urbanized town, where after a brief rest Ms Vallance would resume her sampling.

"We were pretty tired by the time Christmas rolled around. Richard had a bad bout of malaria and hadn't been able to eat for days. On December 22, the Government Coordinator, Robin, came to get us in his dinghy. He had arranged for a government truck to pick us up at Garu, a coastal town east of Kandoka and the closest road link to Kimbe. We departed Kandoka and in four hours we arrived at Garu, soaked and cold and found no truck.

"We unloaded our gear into a big shed filled with people waiting to get to town. A group of women had made a small fire and gave us sweet potato they were roasting. Robin went off into the storm with his dinghy in search of the nearby coastal government station. There he could radio Kimbe and get word on the truck.

"The women were getting worried for a group of rascals had been overheard to say they were going to rob us. The women helped stack our gear in a corner and I sat on my boxes trying to look unintimidated. But the rascals came closer and like everyone in Papua New Guinea, they carried big bush knives.

"At this point I was convinced that all my equipment, notes, and life were in danger. Robin came back saying he'd been lost for two hours but now he was sure he could find the government station. We loaded the boat, set off and got lost.

"The fog was thick and it rained hard.

Everything got wet and we nearly capsized. Eventually we landed on an uninhabited portion of coastline. Robin spent the night blowing on embers, trying to make a fire from sodden branches. Richard and I built a lean-to out of a tarp thrown over a branch under which we put our gear and spread out foam mats.

"No one really slept; rain fell heavily, bugs bit and sand crabs poked up under our mats. By morning I had over 60 insect bites. Our boat was safe on the beach but the cardboard boxes had disintegrated during the night and now we had a mass of unpacked equipment. But we set off in the boat, sure that on this, the 23rd of December, we would reach Kimbe, the island's most urbanized town. What else could happen?

"It took us 45 minutes to find the coastal government station. After receiving assurances our possessions were safe on the beach, we went for the police officer who operated the radio. First piece of news: there was an armed robbery at Garu five minutes after we left. All of the people waiting for the truck were robbed and one person was stabbed. Second item: the bridge between Kimbe and Garu had been washed out in the storm. Third item: no truck will pick us up today."

The following day the Vallances awoke to discover their boat and belongings had been stolen. After a scouting party found the boat and possessions in a nearby village they left by truck for the trip to Kimbe. They arrived on Christmas Eve and celebrated by feasting on chicken soup, ice cream, and wine. After a brief vacation her husband returned to Canada and Ms Vallance started sampling again.

"I spent a week getting the call out for mother and child volunteers. I put an ad on the local radio and I was interviewed for the paper — a story complete with photo. I even gave a talk, in Tok Pisin, to sixty women at the Lutheran church.

"The first week of February I trained my two assistants to help me measure and the following week I began interviewing and measuring height, weight and arm circumferences. I set up in the mother-child health unit at the hospital and business was slow. But it improved when the Maternal and Child Health "sisters" — who are actually nurses — took me with them to the regular clinics they hold throughout the Kimbe. Each day, weather permitting, we set up in a new church,

ON THE SPOT DEVELOPMENT LEARNING

Young Canadian Researchers Awards are offered by IDRC to Canadian graduate students and young professionals challenged by Third World development. The award enables Canadians to conduct scientific investigations or professional internships in developing countries.

Since 1982 IDRC has funded 145 Young Canadian Researchers. This year researchers are examining areas such as water and food shortages in North Africa; genetic changes in fish in Thailand's fish farming industry; uncontrolled settlement in Nigeria's new administrative capital, Abuja; and the influence of working women upon traditional thought in India.

Young Canadian Researchers are affiliated with Third World institutions committed to similar research. These organizations provide supervision and enable the researchers to learn about current conditions in their fields.

IDRC introduced the awards when it realized there weren't enough Canadians with research experience in the Third World. The awards enable Canadian researchers to contribute to development literature by writing graduate-level theses and they help young professionals to enhance their skills and understanding of international development.

Canadians or permanent residents in Canada, enrolled in Ph.D. programs in agriculture, food and nutrition sciences; communications/media; information sciences; law; health sciences; social sciences; earth sciences; engineering and architecture; or Master's-level programs in health sciences; information sciences; communications/media; law; finance and administration are eligible for the awards. Young Canadian professionals in communications/media; finance and administration may also apply. Application forms are available at graduate departments in Canadian universities or write to:

Fellowships and Awards Division,
IDRC
P.O. Box 8500, Ottawa, K1G 3H9,
Canada.



The house the Vallances lived in during their stay in Papua New Guinea.

Photo: R. Vallance

community centre or other accessible building.

"After the nurses finish their work they send all mothers to me. The two kinas (about CA \$2.70) I give each mother is a gift upon completion of work, not an enticement. This system of data collection has worked well: I need twelve more people and I will reach my sampling goal of 150.

"I'm finding some interesting things in the data. There are clear changes in consumption patterns between the very isolated Kwako village, less isolated Kandoka and urban Kimbe. Within Kimbe there are differences in consumption reflecting the degree of dependence on cash wages. Still, 99 percent of urban residents grow traditional foods in gardens. While I found males and females have equal diets in the isolated village, the weak economy of Kandoka is creating inequality in food consumption.

"Kandoka women receive little protein but perform most of the household chores. The breakdown of sex taboos and diminished influence of the men's house, where many men used to sleep, has meant less spacing between children. Only one of the women from the Kandoka sample was neither pregnant nor lactating. Because of the protein they eat, men in Kandoka are fit and muscular, but women display

a gradual depletion of body stores through the years. My reproductive survey shows women give birth to seven to nine children before menopause.

"In rural areas, children between 1 and 2 years-old often have frank kwashiorkor, a protein deficiency resulting in distended bellies. Certainly recalls of their latest 24 hours show a monotonous diet, made worse by customs surrounding the very inadequate breastfeeding and weaning of children. Urban children are better nourished and have greater energy and protein stores reflected in mid-upper arm circumference and fat folds."

After sampling three villages, Ms Vallance returned to Toronto, Canada, in June, 1988 and checked into a hospital to recover from a malarial attack. Soon after she began to assess her data and has targeted June 1989 for completion of her Ph.D. thesis. She will share her findings with the Papua New Guinea Institute of Medical Research, the agency she was affiliated with during her field research. But Ms Vallance hasn't had to wait until her thesis is completed to see results — during her field work she used a "stadiometer" designed at McMaster University to measure height. The device is accurate and inexpensive and so impressed the Institute that they are having two made and sent to them. ■

THE VITA

IDRC believes in the development of a strong body of trained researchers and scientists in developing countries. A professional, indigenous group can tackle obstacles to growth more directly, with a greater under-

BEYOND READING: UNDERSTANDING



"Step 1. Dissolve entire contents of packet in one litre of drinking water." It sounds simple enough, but this instruction on a package of oral rehydration therapy (ORT) solution, a sugar and salt mixture that prevents dehydration due to diarrhea, can easily be botched by someone unaccustomed to one-litre containers or to "dissolve" directions. If, for example, the instructions fail to specify that the water used to make the solution should be pure or that the one-litre container must be clean, the treatment may not work.

Beshah Girma, an Ethiopian who recently completed his IDRC-funded master's of education degree at Canada's McGill University in Montreal, studied whether schooling had any impact upon Ethiopian mothers' administration of ORT on their children. Part of his research was on the comprehension of instructions.

Mr Girma found the number of children saved from diarrheal dehydration, one of the developing world's most virulent killers of pre-school children, could increase, as it has in Gambia, if parents had some knowledge of the causes and effects of the illness.

He discovered mothers with secondary school education from urban areas understood the sickness best and could infer more from ORT package directions than

COMPONENT

standing of national priorities, and with less foreign help.

Here, we profile three individuals who applied their professional training to problems facing their countries.

Name: Beshah Girma

Age: 35

Nationality: Ethiopian

Investigation: How does education influence mothers' understanding of medicine instructions?

Degree: Master's of Education

Institution: McGill University, Montréal, Canada.

could rural mothers with primary-level education. But even amongst equally educated mothers, urban mothers better understood diarrhea's treatment and causes because they had been exposed to television and radio information programs.

Mr Girma, who recently started a doctoral program in nutrition at McGill University, has recommended that the Ethiopian government increase the amount of basic biological science taught in schools, especially at primary levels. He says the case of the Gambia, a country in which early education in science and educational broadcasting resulted in an increase in the effective use of ORT products and a decrease in the number of deaths due to diarrheal dehydration, serves as a good example to the Ethiopian Ministry of Education, the body that would have to translate his work into new educational initiatives.

Mr Girma has sent his thesis to the Ethiopian Science and Technology Commission, a government agency at which he was an assistant research officer and to which he will return. He hopes his findings will be adopted or referred to by the government when designing new school curriculums. Since the impetus for change would come from within the government — and from a national — Mr Girma says the recommendations stand a better chance of being implemented. ■

TEACHING TEACHERS: ADULT EDUCATION IN THE CARIBBEAN



Name: Patricia Ellis

Age: 50

Nationality: Barbadian

Investigation: What makes adult education successful?

Degree: Doctorate in adult education

Institution: University of Southampton, England.

National development in the Caribbean has traditionally meant the formal schooling of young people. But a new approach to development has emerged in the last decade: educating adults outside of the formal education system. Patricia Ellis, a Barbadian who undertook her IDRC-sponsored doctorate in adult education at the University of Southampton, England, found this new policy didn't work unless those who taught adults were themselves trained in adult education techniques and made aware of their role in their country's development.

Dr Ellis began her graduate work in 1983. Using participatory research in her investigation, she asked a group of adult educators, government officials, and NGO representatives several key questions: What and how did they teach? How did their adult students respond to these particular methods? What kind of policies on adult education did their organizations have?

During her field research in Antigua, St Kitts and other Caribbean countries, Dr Ellis organized workshops in which the people she consulted analyzed her findings, added to them, and took them back into the field before she put them into her thesis. She discovered that few adult educators were trained to teach adults. Not all of them received the same training and what they did get was seldom linked to what educators actually practised with adults. Those who travelled to the North for training in graduate education programs often ended up with irrelevant courses and theoretical information which was inappropriate for local application.

Dr Ellis discovered the Caribbean lacked a policy on adult educators and recommended governments incorporate educa-

tion into their development programs. Because educators were unaware of their role and function in development, she found they were frustrated when their notions clashed with those of their agencies.

Dr Ellis' thesis concentrated on extension workers, people who were not necessarily trained as teachers, but were taught health education and agricultural techniques. Because the aim of her study was to increase their competency, she planned from the start to communicate her findings through a final workshop.

The actual workshop took the form of a group training session in St Lucia in March, 1987. In it, the participants learned of Dr Ellis' research findings, again, in an unconventional way. They composed poems, songs and mock television panel discussions to present her thesis findings and analyze the implications on adult education. Beverley Rix, from the World University Service of Canada, who attended the session, noted that while the method of presentation was not in itself innovative — creative participatory teaching is already well-known — the integration of her research findings into the presentations was a maverick approach.

Today Dr Ellis runs an educational consulting firm on Caribbean adult education. She is also secretary-general of the Caribbean Regional Council for Adult Education (CARCAE), the regional NGO responsible for adult training. She says some practitioners have adopted the new strategies outlined in her thesis and the work is now the basis of four courses in adult education at the University of the West Indies. As for a strategy for the 1990s, Dr Ellis says governments and agencies will have to learn to recognize adult education as a tool for development. ■

A SWEETER COMBINATION: INTERCROPPING SUGAR CANE WITH MAIZE



Name: Noël Govinden
Age: 40
Nationality: Mauritian
Investigation: Does intercropping sugar cane with maize increase production?
Degree: Doctorate in Biology
Institution: University of Ottawa, Canada

Only within the last decade have scientists begun to appreciate the 3500 year-old Mexican technique of intercropping — planting more than one crop in the same field at the same time — and begun research aimed at making intercropping more productive.

Noël Govinden, a Mauritian supported by IDRC to pursue a doctorate in biology at the University of Ottawa in Canada, designed an experiment in Mauritius to measure the yields of sugar cane and maize when they are intercropped.

Sugar cane is Mauritius' dominant crop, accounting for 90 percent of the country's farm production and having guaranteed sales at stable prices through an agreement with the United Kingdom. Maize is an important animal feed which is far under-produced: in 1983 Mauritian farmers produced 1500 tonnes of maize while the country's needs stretched to over 14 000 tonnes. The Mauritian government recognizes the importance of other crops but maintains sugar is paramount to the economy and must not be sacrificed to new crop development.

Dr Govinden first discovered, during 15 field experiments in three climatic zones, that intercropped maize and sugar cane compete for light necessary for healthy growth. Still, planted at the right times and with carefully calculated spacing, they could be grown together because of sugar cane's resilient catching up ability. When first planted, maize competes for light with the sugar cane. But maize soon overtakes the cane in growth and wins in the competition for sunlight. As soon as it reaches this height however it is harvested, and the

sugar cane is left alone in the field to catch up in growth lost because of low sunlight.

Ordinarily, the Mauritian farmer plants one sugar cane crop per year. But Dr Govinden found that by intercropping with maize at two-thirds of its normal density, the farmer can not only produce an additional crop, but sugar production remains very near its normal level. Professor John Arnason, Dr Govinden's thesis advisor, calls this a "high-tech cropping system with low capital inputs for developing countries".

During the course of his doctoral work, Dr Govinden was promoted from scientific officer to head of the Food Crop Agronomy Division of the Mauritius Sugar Industry Research Institute. He is now doing research on how to make intercropping of sugar cane with potato, bean and groundnut, more productive. These crops, he found, are more successfully intercropped with sugar cane than with maize. In fact, Mauritius is now self-sufficient in potato, 75 percent of which is intercropped with sugar cane, and in groundnut, 60 percent of which is intercropped with cane. Only 10 of the 21 major sugar cane growers intercrop with maize. Still, this has pushed the country's maize production to 8000 tonnes, fulfilling 40 percent of its maize needs.

Currently, Dr Govinden is creating a computer data base describing the characteristics of all the sugar cane growing lands in Mauritius. He hopes this information will show where intercropping is most feasible. Since he completed his thesis, Dr Govinden has shared his findings at conferences in Zimbabwe, Kenya and most recently at the International Symposium on Potato Intercropping in China. ■

Photo: E. Israel



The new Sino-Canadian Mariculture Research and Training Centre will offer courses for specialists from all over the region. Here, YSFRI representatives greet Brian Davy (holding a binder) in Qingdao.

NG THE SOUTH-SOUTH CTION



EDWARD ISRAEL

Qingdao, a big, bustling summer resort on the north-east coast of China, has for years been home to one of China's most famous beers (also called Tsing'ao) and to over 80 percent of China's oceanography and mariculture experts. Last August, it became the home of the Sino-Canadian Mariculture Research and Training Centre, an organization aimed at training Chinese and other Third World researchers in mariculture — the cultivation of salt-water animals and plants.

The Chinese are undisputed experts in cultivating fish in fresh water ponds, a practice in which they have thousands of years of experience. But scientifically-based mariculture is only a few decades old and until recently Chinese mariculture was based mainly on single species cultivation, or monoculture. However, monoculture suffers from high production costs, underutilization of water and food resources and high mortality rates because of disease and pollution. One of the goals of the Sino-Canadian project is to develop an efficient multi-species, or polyculture, system for marine ponds.

The Chinese government is eager to develop commercial mariculture operations to meet expanding domestic and international demand for profitable seafood such as oysters, scallops and giant shrimp. The Chinese hope the Centre, located on the grounds of the Yellow Sea Fisheries Research Institute (YSFRI), will strengthen the country's mariculture research capabilities.

The first step in the project was to improve the training of YSFRI scientists in the detailed biology of the animals and seaweeds they plan to cultivate.

Xueliang Xu, head of YSFRI's fish nutrition project, came to Canada's Dalhousie University in Halifax to study the role of lipids and fatty acids in marine animal nutrition, specifically the giant prawn *Penaeus orientalis*. Hong-wei Yu, another YSFRI scientist, travelled to the University of Alberta's department of microbiology to learn about fish disease.

The second step is to develop training courses for Third World scientists based on the Chinese experience in mariculture. When Dr Xu and Dr Yu return to YSFRI with their increased knowledge of marine biology and English, they will design training materials on seaweed with the help of a Canadian expert on education, from the World University Service of Canada. YSFRI researchers have little experience in teaching but Brian Davy, associate director for fisheries at IDRC, says they are eager to share their technology.

"This project is very much in the spirit of South-South cooperation. There's a lot of potential here; they're very interested in passing their knowledge on to other developing countries. It's a good marriage," says Dr. Davy.

This type of South-South cooperation

ensures that insights and expertise gained by researchers in one area of the developing world are transferred and applied to other areas of the developing world. Researchers believe this is a more sensitive and appropriate approach to development than countries of the North can provide.

In the last 40 years China has pushed monoculture production of the *Haidai* species of seaweed from 40 tonnes to more than 200 000 tonnes. As a result *Haidai* has become China's main seaweed product and China one of the world's largest producers. Seaweed, apart from being a popular seafood, is used in industry as a thickening agent for such foods as jams and jellies, as a stiffener in cloth, and has applications as varied as cosmetics and dog food manufacture.

Scientists plan experiments on two species of seaweed, *Laminaria* and *Undaria*, in combination with scallops. Researchers will examine light, water currents, depth and fertilizer to develop higher yielding varieties and growing methods that maximize harvests.

The first course at the Sino-Canadian Mariculture Research Centre is scheduled to be held in 1990 and will last eight weeks. All courses will be held in English, the language used in most international scientific journals. Construction of dormitories and other facilities for the trainees is already underway. It is hoped that this form of human resource development will ensure that the development YSFRI undergoes is sustained rather than ephemeral. It is when the Chinese researchers begin to teach modern mariculture technology to other researchers from developing nations that South-South cooperation will begin.

But Dr Davy says planners and researchers still have a lengthy path in front of them. "The teaching materials have to be prepared, and prepared for maximum benefit in a very heterogeneous class. Then we have to identify the trainees, ones from nations about to get into seaweed farming, ones from appropriate institutions. There's still a lot of work to be done," he says.

For more information about the courses at YSFRI please write:

*Sino-Canadian Mariculture Research and Training Centre
19 Laiyang Road, Qingdao
People's Republic of China*



Photo: J.M. Fleury

A LAND SCARRED BY EROSION



Deep gulleys in Swaziland show just how much the land has eroded. Geomorphologist Musba Songwe is studying this phenomenon and working on solutions such as constructing small dams which slow down the water flow (extreme right).

Photos: D. Marchand



DENIS MARCHAND

“**W**e have to make people realize that the mountains are falling down around them!,” Musha Songwe, a geomorphologist working on how gullies are formed in western Swaziland, a tiny country nestled between South Africa and Mozambique, can’t hide his anxiety.

“Of course, it’s difficult to estimate the number of hectares of arable land lost each year, or the number of tonnes of sediment that are washed into the rivers and streams. But it’s easy to see that erosion has taken on alarming proportions over the last few years,” says Mr Songwe.

The existence of “dongas” is by no means a recent phenomenon. As early as 1930, European missionaries noted “the appearance of shallow fissures on the mountain slopes”. Today, however, the Ministry of Natural Resources estimates that there are about 2500 “dongas” in the country, some of which are 500 metres long and 30 metres deep.

Mr Songwe says the “dongas” occur mainly because of poor land and livestock management. “The land was cleared, cultivated, and then left to the cattle to graze on. The soil is very fragile, especially as there is no plant cover to protect it. Be-

cause of an irreversible process of erosion, Swaziland is becoming a mountainous desert.”

Above altitudes of 1000 metres, the gullies generally start in natural pastures, such as the paths trod regularly by cattle. They also form along dirt roads which are poorly maintained and drained.

Although deforestation, overworking of the soil, and overgrazing all contribute to the formation of “dongas”, Mr Songwe also stresses the role soil structure plays in the process, especially in areas below 800 metres. His studies into various sites that have been severely affected by erosion reveal that the soil is composed mainly of volcanic rock, limestone and basalt. “These factors also contribute to the salination of streams,” he says. He adds that erosion, besides reducing the amount of arable and natural grazing land, also contributes to the silting, contamination and even the disappearance of shallow streams.

Farmers who have planted sugar cane, orange, grapefruit or vegetables along the rivers, are worried about the presence of sodium chlorate and other chemicals in the water. They are afraid these chemicals will endanger irrigated crops which have been very successful over the past few years. Already, small whitish deposits can be found on the soil.

This concern is shared by a number of fishermen, who feel that the accumulation of such sediments in ponds and rivers may cause the fish to abandon the waters or prevent them from reproducing.

The formation of alluvial deposits in the rivers and near hydroelectric dams is also cause for considerable worry. It is claimed that the presence of these deposits accelerates evaporation and causes water bodies to dry up — another step toward desertification.

The research undertaken by Swaziland’s Ministry of Natural Resources, with the financial support of IDRC, is the first of its kind in southern Africa. The researchers want to determine the nature and cause of this ecological problem, and establish a program to solve it.

Eighty percent of Swaziland’s 800 000 people inhabit rural areas, eking out a living based on subsistence farming and small-scale cattle farming. To stabilize the plant cover and protect the farmland, the farmers must plant fodder hedges, trees and bushes — work which is just beginning. ■

Denis Marchand is a freelance journalist interested in development issues.

LOSING A WAY OF LIFE

MALI'S NOMADS

COLLEEN THORPE

Photos: C. Thorpe



In the village of Im Naghil, on the desert lands of Northwestern Mali, Mossa Ag Timika sits and waits for the rain. If the rain doesn't come his sorghum crop will be lost. He is impatient. In the past, if there was no water in one area, he would pack his belongings and move with his family to another area. Mossa Ag (Ag means son of) Timika longs for the days when he used to steer his herds of animals to greener pastures. But now, green pastures are scarce and he has lost more than 80 percent of his livestock to drought. He doesn't have enough animals to support such a move or even to feed his family.

"Before, a family of about 20 would own about 100 goats, 10 sheep, 10 cows and 10 camels. Now, a family is considered lucky if it owns a few goats. Sedentation (settlement) has become an obligation." Without land to graze on, animals die and the nomads are forced to move to land which they can cultivate and raise food crops on.

As chief of Im Naghil, Mr Mossa speaks for the thousand other Touaregs of the village. The increasing drought of the past 20 years has forced nomadic groups such as the Tuaregs, Bellas, Maures and Peuhls who roam the Sudano-Sahelien region of West Africa to settle.

Settling in a village has meant choosing survival says Mr Mossa, but life has not improved much since the crippling drought of 1985-86 when he first settled in Im Naghil. After three years, his village is still not self-sufficient and depends on foreign aid agencies for food.

Just over 400 kilometres southeast of Im Naghil, on more fertile lands in the village of Palole Walo, a group of sedentarized Bella nomads are in a similar predicament — for three years they too have been struggling to survive.

"Our harvest is too little. Farming life is difficult compared with our nomadic way of life. Before, we could go for two days surviving on just a little milk from the

Nomads forced to settle are turning towards crafts to earn a living. But without animals they don't have enough leather and are often forced to use synthetic materials.



animals. But we can't do one day of farming without eating. We are forced to sneak out at night and cut wood illegally in order to get enough money to buy food," explains Hebraim Dicko, a villager. He says Palole Walo needs help to survive.

The villagers of Palole Walo and Im Naghil aren't the only ones asking for help. In the Tombouctou region of northern Mali, over one-third of the population are nomads and in the Gao region over half the population is nomadic. Over 450 000 nomads live in Mali.

Nomadism is a simple system of resource management; nomads move depending on the availability of natural resources. Because they are constantly in motion, the environment has a chance to recover from their passage. Sedentation has brought about heavy demographic pressure on certain areas of the country, namely riverbanks or areas near water points. In these areas, the need for fuelwood and construction materials, the clearing of land for agriculture and the constant grazing of the nomads livestock has brought about massive destruction of the vegetative cover.

To determine what kind of help the nomads need, the Malian Office of Natural Resources and Livestock, with IDRC funding, completed a demographic study on the environmental and social consequences of sedentation in June 1988.

The researchers interviewed 180 chiefs and 162 women living in settlements and 15 chiefs and 13 women living in nomadic camps. Out of 18 known nomadic camps, the researchers were only able to find 7 because of the continuous movement of the nomads.

The researchers suggest the government should regulate settlement sites, designating some areas as grazing lands for animals and reserving other areas for agriculture, and continuing the fight against desertification with reforestation programs.

Youssef Manian Diarra, the project leader, points out however that environmental problems have economic roots.

Nomads are pastoralists; livestock raising is their single most important activity. In the nomadic social hierarchy, raising livestock was a sign of nobility, cultivating the land meant a lower social class. In the village of Palole Walo, the nomads have not succeeded in living off the land. Consequently, cutting and selling wood has become their livelihood. The study suggests the nomads be helped in reconstituting some of their livestock. But it also recommends that for sedentation to become viable the nomads must diversify their sphere of activities to include market gardening and farming cereal grains. To do this, they will not only need materials such as seeds and tools, but more importantly they will have to be taught farming techniques.

For the people of Palole Walo, this would work well as they are located in an oasis; water is plentiful and the flood plains are well-suited to vegetable growing.

This isn't the case in more arid areas such as Im Naghil where agriculture is difficult but nomads have settled nonetheless because it is their traditional roaming zone. The villagers there scantily supplement their income by selling arts and crafts. For this to become a viable livelihood, they will need more materials because the loss of animals has meant the loss of leather. They are now forced to use synthetics for their artwork.

Whether it be the artisan industry, cereal production, market gardening or sedentary livestock rearing, the study recommends that the nomads organize themselves into cooperatives to manage their activities. Mr Diarra says the government should complete the developmental framework by implementing social programs including education and health care. But once the framework is set intervention should be minimal.

Development within the nomadic community will also be slow. Sedentation means more than just settling as the word

suggests; to the nomads it means giving up their freedom. The researchers believe that without adequate inputs and training in settled agricultural practices, the nomads will only remain in settlements until they can return to the nomadic way of life. They say that for sedentation to work the nomads must get some satisfaction out of their new way of life.

"The nomad has no conception of limited space. He knows no frontiers and can't understand how someone can appropriate space," says Ambeiry Ag Rhissa, a former nomad who now works for the government.

"It's abandoning one lifestyle to take on another," says Mr Ambeiry. That means changing such fundamental things as eating habits — nomads whose diet consists of milk and meat are not partial to the taste of millet, sorghum, fruits or vegetables. "I used to be a lot bigger and stronger," says Mr Mossa. "Now I am weak and my skin is flaccid."

Sedentation is welcomed by some as the only option. "We understand that with sedentation we are able to overcome many obstacles. If the government succeeds in helping us, we will never leave this area," says Mr Dicko.

For others sedentation means a loss of culture. Mr Mossa says he will always be nostalgic for the old way of life. But he is afraid the old ways will die with his generation. "If sedentation continues and if the nomads take on new activities, our culture will disappear. Our children will not even know what a camel is if they only see fields of millet and sorghum. They will become different Tuaregs."

Colleen Thorpe is a freelance journalist based in Ottawa, Canada. She travelled to Mali last summer with World University Service of Canada.

A LOOMING REVOLUTION IN PAKISTAN



Photos: R. Charbonneau

Children playing in the narrow streets of Multan, Pakistan, are louder than children elsewhere. They have to compete with a deafening din — the rhythmic percussion of weaving looms in every small house in the neighbourhood!

ROBERT CHARBONNEAU

Twenty-five times a minute, the shuttle is thrown across the warp with a clatter. Gradually, the spool empties. While the weaver keeps a firm grip on the slack he picks up the shuttle and with lightning speed attaches another bobbin to it. A short pause and the noise starts again...

Each house on this street has six or seven different looms inside: plain looms for

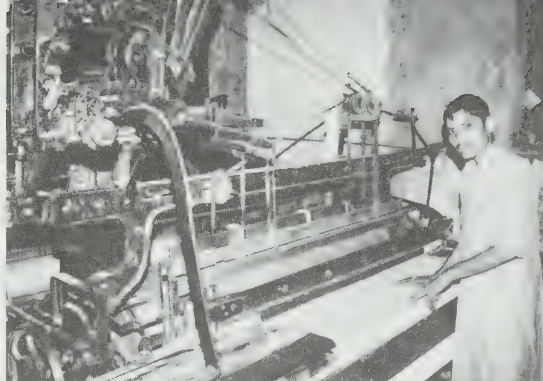
plain fabrics; multiple filament looms for fabrics with designs or texture; and for more elaborate or large-scale designs, Jacquard looms that still use old perforated cards to create a pattern. At regular intervals, the card darts into the Jacquard loom, picks up some filaments, moves others, and produces a design.

The results of this noise — magnificent cotton fabrics that account for 60 percent of Pakistan's export revenues, over US \$4

billion annually. Most are produced by tiny cottage industries found in the small inner courtyards of houses such as the ones in Multan. The weavers still use ancient looms reminiscent of the early 20th century with heavy steel mountings, springs and gear wheels.

But customers are increasingly demanding. Although plain cloth, ready to be printed or dyed, has kept its share of the market, more and more buyers are look-

The potential market for this new invention is well over 2 million buyers. Opposite, a weaver operates a loom with a conventional dobby. In the box, trying out the new Pakistani-Canadian model. Extreme right, an apprentice learns how to make a bolt.



ing for textured fabrics with unobtrusive designs that are only apparent through touch. These textiles cannot be produced without a dobby mechanism which, fastened to the loom and pulled by the machine, selects warp threads to form a pattern. Dobbies are expensive in developing countries since they must be imported from abroad, mainly West Germany, Japan and Switzerland, and paid for with hard currencies. They can cost twice or even three times as much as a used loom, or over CA\$10 000 per unit.

This is where Wasey Omar steps in. From the beginning of his career in the textile industry, this Pakistani engineer has been impassioned by looms. Even before completing his Master's degree, he had decided to revolutionize textile manufacturing by designing simpler equipment. In 18 years of research, he has accumulated several patents for dobbies.

Wasey Omar didn't even try to improve the existing equipment. He went back to the source and asked what had to be done to control as many as twelve warp threads without resorting to the clumsy mechanism that had been used by the industry for over 125 years.

And then he developed a dobby that requires only two moving parts for each filament rather than ten. This new invention can control up to fifteen warps while occupying only one-fifth of the volume of its predecessors. The inertial mass is reduced by thirty percent, energy consumption drops precipitously, and the risks of breaking are considerably reduced.

Obviously, the manufacturing costs of equipment as simple as this are quite competitive. Estimates drawn up during prototype construction indicate that the dobby could be manufactured in series production for one-tenth of the price charged by existing competitors.

Approximately one-third of the looms in use in the Third World are dobby-equipped. It is believed that the number of these looms, estimated at 2 700 000, will remain stable until the year 2000.

The market is vast. There are an estimated 1 780 000 looms without dobbies that could have them installed. Moreover, 50 percent of the dobbies now on the market will have to be replaced over the next 10 years, which brings the potential market for Mr Omar's invention to 2 400 000.

The largest markets include China and India, each having over half a million looms, followed in decreasing order by Pakistan, Brazil, Indonesia, Thailand, Egypt and Turkey. All of these countries are being seriously considered as manufac-

turing sites. Patents have already been applied for in several countries, including Canada.

Wasey Omar is not alone. The *Pakistan Council of Scientific and Industrial Research* (PCSIR) in Lahore, Pakistan, and IDRC have both contributed to the experiment.

Before series production could begin, Mr Omar's plans had to be finetuned. Engineers at the *Industrial Technology Centre* (ITC) in Manitoba, Canada, analyzed Mr Omar's plans. Using modern computer-aided design techniques, ITC technicians and engineers reassessed each of the model's parameters to optimize its performance. These thousands of hours of

effort resulted in the first prototype: the PAKCAN, now undergoing trials in Pakistan to determine component wear and design flaws that might have gone unnoticed during theoretical studies. Another prototype will then be manufactured to check that all the improvements have indeed been incorporated.

Then, sixty dobbies will be manufactured by small local Pakistani plants to verify Third-World production capacity for dobbies using local materials, technologies and know-how. If the small businesses succeed, developing countries will be freed forever from importing heavily-taxed foreign manufactured equipment.

This new dobby is the forerunner of a

WHAT IS WARP SELECTION?

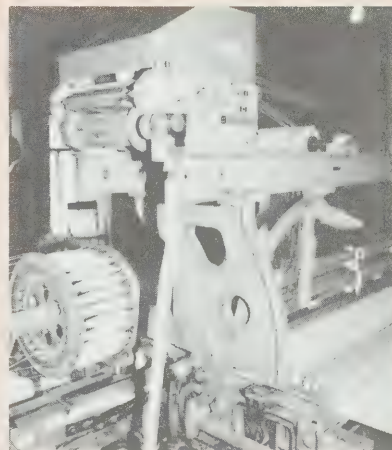
To produce plain crossed-thread patterns, the warp (threads running vertically on the loom) is divided into two parts. Half of the threads are pulled up and half are pulled down by the blades. The shuttle is propelled through these threads by wooden bats that strike it alternately from either end of the loom. The shuttle unrolls the weft thread as it moves across the loom forming the new cloth. The simplest version of a loom consists of two warps activated alternately by a pedal.

To produce more complex patterns, the number of warps is increased and a selection pattern is introduced, which changes the final texture of the fabric.

The selection mechanism is called a dobby. It is designed to choose from a combination of several warps (up to 15 and even 32 in the case of a Jacquard loom). The dobby is programmed to repeat a predetermined sequence over and over again. The arrangement of warps provides different options for the passage of the shuttle.

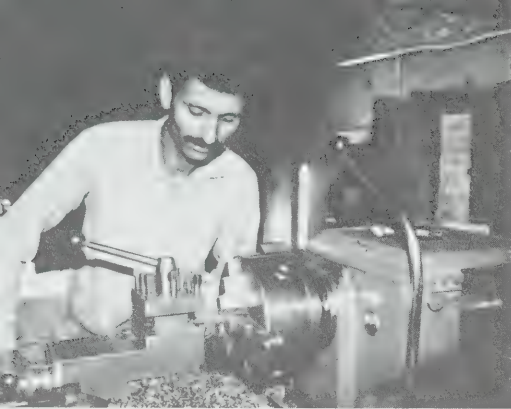
This produces textured fabrics with small-scale relief designs. The Jacquard loom, named after its inventor, is used for more complex designs.

Most looms in use in the Third World are relatively old and operate at a rate of approximately 80 to 100 shuttle passes per minute. Two-thirds of these



looms have only two warps. Without a dobby, they can only produce plain cloth.

The selection mechanism developed by Wasey Omar uses 14 fewer warps. The prototype can maintain a rate of 140 shuttle passes a minute. With certain modifications, the researchers believe the same machine could maintain a rate of 600 passes a minute. At the present rate of 140, the looms can generate 6 or 7 metres of fabric per hour. ■



VALLEY OF THE BLIND

With more than 7000 cases of blindness, the Luapula Valley is a public health hotspot for Zambia. A team of researchers has confirmed that vitamin A deficiency is a major culprit. In general, they say, most cases of blindness are preventable.

real textile industry revolution in the Third World. Manufacturers in developing countries will have access to an immense market and to high technology designed with their resources and limitations in mind. Small-scale weavers who have only a few looms will be able to use a new technology which is within their financial grasp. Their production will benefit because dobby-produced fabrics sell for 30 percent more than simple cloth.

Mechanical industries in Pakistan will also benefit from the government's intention to offer 250 million rupees in low-interest loans to small-scale weavers so that they can modernize their equipment. The government has also expressed its intention to reserve part of its export volumes for small weaving businesses. As things stand now, although small-scale weaving provides a good portion of production, middlemen siphon off most of the profits.

Behind his glasses, Wasey Omar's eyes light up when he thinks of the future: "This is my life. Seventy-five percent of the world market is opening up for us. If Canadian or other manufacturers come in with us, we can dethrone the Keighley Dobby, which was developed in 1867."

Negotiations are underway for construction of the first prototype that will help define manufacturing procedures for small weaving shops. Mohammad Masud of the *Supreme Engineering Works*, a small business in Multan that produces spare parts for the textile industry, has already expressed interest in manufacturing the prototype and possibly acquiring manufacturing rights for Pakistan. "We know there is a demand for inexpensive equipment. We're interested," says Mr Masud, the proprietor of a small shop with ten employees.

When the first factory trials have been completed, buyers of the manufacturing rights will be offered a blueprint on how to produce the dobby. And another manual, this one for equipment users, on how to install and maintain the dobby is also being considered. It would enable small-scale weavers to get the best possible yield from an invention that was designed with them in mind. ■



Photos: D. Mwandu

DANIEL LUBINGA

About 30 million people in the world today are blind, according to estimates by the World Health Organization. Ninety-three percent of them live in developing countries, with Africa accounting for about 20 percent of the world total.

The general term "blindness" is defined by WHO as the inability to count fingers from a distance of 3 metres.

The significance of the statistics is that the incidence of blindness in developing countries is nearly 20 times higher than in the industrialized countries. This calls for pragmatic measures to curb this scourge and to improve the living conditions of the blind.

Zambia has a population of about 7 million. A total of 12 750 people — or about one in 550 — are listed as completely blind.

"This is probably less than the actual number of the blind," says Dr Everest Njelesani, the director of medical services at the Ministry of Health. "The number of

those with various degrees of sight impairment must be much higher."

Following an extensive survey investigating the causes of blindness in an area known as the Luapula Valley, steps are now being taken to redress the situation.

To help Zambia better understand and deal with blindness, IDRC provided financial support for the Luapula Valley Eye Disease Survey in 1985. The researchers are attempting to identify the magnitude and causes of eye disease and blindness in the Valley so that interventions can be planned.

The area, located in the northwest of Luapula Province in northern Zambia, is not called the "Valley of the Blind" for nothing. With a total of 7265 cases (1985 figure), it has the highest rate of blindness in the country.

Medical experts admit that blindness has been an important public health problem in the area for well over 50 years. Few researchers, however, have been able to provide concrete evidence as to the actual causes of blindness in the Luapula.

Eye-examinations and reading tests helped researchers discover what caused blindness in the valley.



In the past, the explanations advanced have been a matter of speculation. Among the vast majority of Zambians, the belief has long persisted that blindness in the Valley is due to the high consumption of contaminated fish.

A prominent Zambian traditional healer "Dr" Rodwell Vongo has his own contribution to the incessant debate. He told a seminar on eye diseases in Africa last February that blindness was also caused by magic, (witchcraft), evil spirits, ghosts, and man-made genies. Furthermore, "heavy smoking of tobacco, especially in pipe, over many years produces disturbances and leads to visual failure especially to distinguish red colour."

Previous scientific research suggests that the causes of blindness in the valley are much less certain. "When we looked at the literature since 1945, when the Royal Commonwealth Society for the Blind conducted research, we found conflicting reports as to the cause of blindness," explains David Mwandu, co-principal investigator for the Luapula Valley Eye Disease Survey.

Mr Mwandu, a nutritionist with the Tropical Diseases Research Centre in the city of Ndola, said the work of these early researchers was mostly sporadic, done by individuals, and their results made it impossible for the government to institute preventive measures.

In 1955, John Wilson visited Mununga and concluded that "mutti", a local eye ointment, was responsible for eye disease. "It is my firm conviction that these African preparations are the main cause of the... lesions," Mr Wilson declared.

In 1961, the Royal Commonwealth Society for the Blind sent a physician to the Kambowa Centre for the Blind near Ndola to examine blind children from Luapula Valley. The visiting doctor reported that the principal cause of blindness was corneal "necrosis" (death of living tissue) due to malnutrition during infancy and early childhood. This was precipitated by debilitating diseases such as measles and aggravated by secondary infections and by native treatment.

Freelance journalist Ephraim Sumaili is one victim of eye disease who spent his early childhood in the Valley. He supports the contention that local medicine was the cause rather than the cure, saying he himself nearly went blind because of it. "My eyes just got worse and worse with the

mutti that was applied to them." Mr Sumaili said he finally refused the herbal treatment and instead sought medical help from a government health centre.

But that plethora of conflicting reports may finally have found its resting ground with the results of the recent survey. In the dry season of 1985, between August and December, a number of interested groups collaborated to conduct a survey in the Luapula with some 23 field staff led by Mr Mwandu. The partnership included the Tropical Diseases Research Centre, the Zambia Flying Doctor Service, the National Food and Nutrition Commission, the Ministry of Health, and the International Centre for Epidemiologic and Preventive Ophthalmology.

Based on WHO guidelines, 7000 people from 110 villages were surveyed; 5000 of the participants were under six years old.

Individuals in the sample were examined at a central point in the village. Subjects were screened for eye disease and blindness by means of a visual acuity test in which a series of increasingly small letters known as the Landolt E chart is read. This was supplemented by a test using a pinhole device. Those whose vision proved to be below an established level underwent eye examinations with an ophthalmoscope and other devices to determine the cause of the problem.

To identify malnutrition in children, weight and height were recorded and any history of infectious diseases noted. From blood samples, vitamin A levels were measured. Subjects were also interviewed to establish socioeconomic conditions, food consumption patterns, and use of health facilities.

According to the findings, two percent of pre-school children in Luapula had xerophthalmia (Greek for "dry eye"), a disease caused by vitamin A deficiency. It was found to be a major cause of blindness in the children.

Unfortunately, the Luapula Valley is lacking in most of the foods rich in vitamin A — such as meat (especially liver), eggs, milk, butter, green leafy vegetables, carrots, mangoes and papaya. Mangoes, papaya, and bananas are grown mainly between November and March and eaten only when they're in season.

Green vegetables are grown in small quantities. Meat and milk, however, are not available as very few domestic animals are raised in the area. Fish are abundant,

but their livers, which are rich in vitamin A, are normally removed before eating. Furthermore, most of the fish catch is taken to the nearby Copperbelt and other parts of Zambia where it is sold for cash.

Analysis of blood samples taken during the survey revealed that 75 percent of the children were deficient in vitamin A. Other contributing factors in the development of xerophthalmia are malnutrition, measles, malaria, diarrhea, upper respiratory infections, poor diet, and a lack of suitable weaning foods.

The survey also revealed an overall prevalence of nearly 7 percent for cataracts and nearly 3 percent for corneal opacities among the survey population.

As for trachoma, a contagious eye disease related to poor sanitary conditions, its overall prevalence was 13.4 percent. Trachoma is an inflammation of the mucous membranes on the inner surface of the eyelids, and is caused by a pathogenic microorganism called chlamydia. Acute forms of trachoma were observed mainly in those younger than 50, whereas complications were common in those older than 50.

To combat xerophthalmia it was recommended that vitamin A capsules be distributed on a mass scale through community health workers, village headmen, and rural health centre staff, as well as through child immunization programs.

For trachoma, it was recommended that tetracycline eye ointment be made available through the same distribution system. But the researchers also recommended health education through schools, women's clubs, and rural health centres.

For cataracts, it was recommended that surgical services be extended to rural hospitals, and that service through mobile eye clinics be boosted. Additionally, efforts to immunize preschool children against measles should be intensified within hospitals, clinics, and mobile health care units.

The survey team noted that the vast majority of blindness in the Luapula Valley is preventable. The problem of eye disease and blindness is the responsibility of both of the individual and of many other sectors of society. In particular, health, agriculture, education, and local government have key roles to play. ■

Daniel Lubinga is a freelance journalist based in Ndola, Zambia.

BETTER RESULTS IN THE FIELD



Photos: R. Charbonneau

Every two weeks, Moawad Abdel-Fattah meets with sheep farmers from the village of Balashon. He weighs their animals and drinks tea with them. The farmers talk to him and each other about the temperature, their families, their crops and their sheep. Abdel-Fattah is an agricultural advisor for the Egyptian Ministry of Agriculture.

ROBERT CHARBONNEAU

Like the farmers he visits, Mr Abdel-Fattah also lives in Balashon, about 70 kilometres east of Cairo. He and his friends are small farmers, owning only a few "feddans" of land (1 feddan = 0.1 hectare). Mr Abdel-Fattah owns seven sheep and four buffalo. He is working with 26 villagers on a project, supervised by the Animal Production Research Institute and supported by IDRC, to introduce new breeds of sheep to the area. Mr Abdel-Fattah's own sheep are crossbred. He says, "If I don't take advantage of the new technology, how can I expect the others to?"

The province of Sharkieh, in which Balashon is located, has the largest population of sheep in the entire Nile Delta — 200 000 head. From the doorway of a house or the corner of an alley, one can often see a child guarding a few lambs, or a cart full of clover for the sheep.

In Sharkieh, sheep are raised mainly for meat, not for wool. The family of Abdel-Aziz Ghozia owns a single "feddan", on which the five members grow an equal amount of wheat and clover. Maize is also grown as a rotation crop. Mr Ghozia's daughter, Thanaa, looks after the family's three sheep which were bought at market price (about 90 Egyptian pounds) from the Ministry research station. The goal of the station is to improve sheep lines in Egypt. Their newest cross combines the resistance of local species (Rhamani and Ossimi) with the rapid weight gain and fertility of the Finnish breed. The most popular cross in this new type is one-quarter Finn, three-

Left, Thanaa and her three sheep — soon to be seven! Right, a villager at the bi-monthly weighing of sheep, helps researchers gather the data they need about breeding patterns.



quarters local. The village's one ram is also crossbred and is used to breed ewes. The Ghozia family's menagerie is completed by a water buffalo, two goats, and a few ducks and chickens fed on scraps.

Thanaa finds it easier to raise sheep than buffalo, and would willingly take care of a larger herd. The researchers have provided for that possibility, as the cross is very prolific. Three lambs have already been born, and another ewe is about to deliver. "In two weeks, each sheep has gained four kilos," says Thanaa with enthusiasm. "I could sell two sheep this year. At the Thursday market, before the holidays (when the prices are best), I could easily make 200 pounds (CA\$110) a sheep."

The new crosses have many advantages over those traditionally raised in the area. First of all, they are more fertile — an average of 1.6 lambs are born per litter, as opposed to 1.2 for the local species. Secondly, their weight at selling time is 40 kilograms, higher than the average by 5 kilos. These two characteristics alone make it possible to increase the amount of meat sold every year by 52 percent.

Although the researchers had already determined the most advantageous crosses at the Ministry research station in Sakha (north-east of Cairo, in the Delta), and for a decade had been recording precise figures about reproduction rates, weight gain, peri- and post-natal mortality and other variables, they were pleasantly surprised when the project actually got underway. Professor Aboul-Ela from the University of Mansoura explains: "The farmers are getting better results than we

are. These are very small operations we're talking about — just a few animals. But the sheep are very well cared for. When an animal isn't eating well or seems ill, they take care of it immediately. The result of all this attention is measurable. Weight gain is better than at the station, and mortality is lower. The feed the sheep receive is richer in protein since the farmers always find green plants to feed their sheep. They also are very careful to ensure that the animal is bred. As a consequence of all this, they get more twin births than we do."

The whole project began with an invitation. Agricultural extension workers took about 15 farmers to the Sakha research station to show them new crosses that could be used to improve their herds. The farmers were particularly impressed by the fact that the crosses retained certain characteristics of the local species, such as the heavy tail that can represent over 10 percent of the weight of the animal (the oil from the tail is used a great deal in cooking). The farmers even had a course on small-herd management. They learned, for example, that it is possible to increase the rate of production through controlled mating and weaning. They now get a litter every eight months.

So far, 82 farmers have participated in the introduction of the new crosses, and from now on up to 120 could be involved per year. According to the Governorate of Sharkieh, the researchers now intend to concentrate on the Dakahlia region (which has the second largest sheep population in the country) and then the Ismailia region

(near the Suez Canal) recently reclaimed from the desert.

Egypt has four million head of sheep, and, among the 15 subtropical countries that have attempted the experiment, it is the only one to have successfully introduced the Finnish breed.

The farmers are reaping the benefits. At the research station, for each 100 ewes bred at the station, 83 will conceive. The farmers' average is 91. As for the number of lambs born per litter, the farmers' average is higher, as well.

The investment required of the farmers is minimal — a single ram can father 5000 lambs. Mr Aboul-Naga, the project manager, explains: "The project's success is related to the goals that were set. We were not trying to develop an advanced breeding technique; the objective was to teach the farmers simple, accessible methods that they could put to use immediately. For example, we did not use concentrates, as most of the farmers would not be able to obtain them. And we decided to work with the most needy farmers — the ones with only two or three animals. They also constitute the largest group in this country."

"If a small farmer with five sheep can sell ten lambs a year at 100 pounds each, this means an income of 1000 pounds per year. That's a lot of money!", says Aboul-Naga.

He adds: "It's harder working in the field. We won't have a lot of results to publish. We're concentrating our expertise on development, and we know very well we won't get any scientific recognition for that!" ■

SLUM IMPROVEMENT: WHO BENEFITS?

MEERA BAPAT



Photos: R. Charbonneau

Community participation and self-help — catchwords for nearly two decades, mentioned often in the literature on

slums and squatter settlements in cities in the Third World. But what do they mean?

Flimsily built shanties precariously perched on hill slopes and river banks, tattered polythene providing a roof for whole families... The squalor and quagmire of squatter areas became familiar sights as cities began to grow rapidly in the 1950s and 1960s and the proportion of people living in squatter settlements started increasing at what was perceived to be an “alarming” rate. The middle and upper classes believed such illegal and unhygienic settlements existed solely because of the lack of prompt and stern action by the authorities to demolish such structures.

Governments attempted, although on a negligible scale, slum clearance and rehousing of people in walk-up flats or high-rise buildings. Experience has shown that this approach is unsustainable. Constraints and competing demands on resources permit only small budgetary allocations for public housing programmes (less than 3.5 percent of GDP in Asia and Africa and 5.5 percent in Latin America). And since housing is regarded as a welfare activity, it is accorded a low priority.

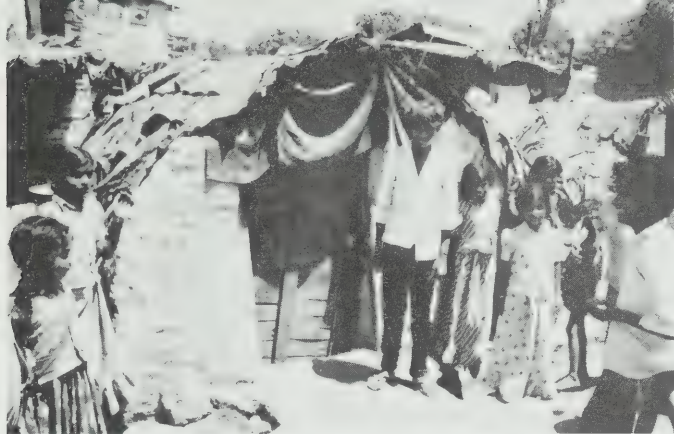
Heavy subsidies are needed to bring housing within the reach of low-income families. The inability of the poor to afford new housing leads to sub-letting to better-off families. However, when affordable housing is scarce even for the better-off, the poor or original beneficiaries end up selling their homes to higher income families. The poor are thus dispossessed because they trade their housing space for cash to add to their

meagre incomes and resort to building hovels in squatter settlements. This is often interpreted as their preference for living in squalid conditions — a manifestation of their “slum mentality”. In reality, however, this must be understood as their economic rationality since living in a “decent” house cannot be a substitute for desperately needed food or medical care.

Public housing has made no more than a negligible contribution towards ameliorating the problem of shelter that is so visible in Third World cities. While the “urban explosion” continues unabated, an increasingly larger proportion of the urban population is having to live in abysmally deplorable conditions. Nearly half the population of Bombay, Bogota or Dacca lives in what can only be an apology for shelter.

Towards the end of the 1960s, a British architect, based on his work with squatter communities in Lima, Peru, presented a view of their settlements which contradicted what was popularly believed. He stressed that squatter settlements are not a problem but a solution to the problem of housing: the *barriada* is not a slum but a building site. The people know their own needs and priorities better than planners and government officials: based on their requirements and preferences, they choose vacant land and build their houses progressively. He urged decision makers to recognize and support self-help efforts of squatters in establishing their homes and communities.

A new approach has emerged based on isolated “success” stories of squatter communities organizing house building, improving housing and managing their environment. In the past two decades, the “self-help school” has presented one of the most persuasive arguments in defence



of squatters. Over the years, governments have co-opted the new terminology. They mention community participation as a key factor in the success of any programme. Recent Indian housing policy documents, for instance, clearly state that rather than building houses for the low-income population, the government should facilitate and not regulate housing activity. A pertinent question is: why have the "revolutionary" ideas of community participation and self-help found acceptance in government circles?

This question cannot be answered without looking at the legislation and practice of urban development. India can serve as a good illustration — it has a long tradition of Town Planning. The first Town Planning Act, introduced by the British, was passed in 1915. Since then, it has been superseded and its scope enlarged, but its essential features remain unchanged to this day. Each city/town authority must prepare a Development Plan for the area within its jurisdiction.

A Development Plan is primarily a land-use map. It is prepared after making detailed surveys of the existing housing situation including facilities and amenities. Based on population projections for the next decade, it assesses the need for housing and infrastructure (such as roads, sewerage, water supply, schools, open spaces, traffic and transportation networks), and proposes a plan for their fulfillment.

In spite of Town Planning efforts over the past seven decades, towns and cities in India bear vivid testimony to the ever worsening living conditions of a majority of urban residents. Experience has shown that the extent to which these elaborately prepared Development Plans take concrete shape is woefully small. For instance, only 10 percent of the proposals made in the last

Development Plan of Bombay actually materialised during that decade. The principal constraint is the lack of funds.

If this is the situation, why is the cumbersome and time-consuming exercise of preparing Development Plans done ritually every ten years or so?

Town Planning determines the distribution of a city's resources such as land and water among different groups of city residents. Since it takes place within the context of the urban land market and real estate development, it creates infrastructural advantages (roads, open spaces, transport facilities) so that private builders can reap benefits.

Land is one of the most important determinants of city plans. Accessibility and neighborhood characteristics determine the price of urban land. The price curve shows that land prices decline from the city centre (the centre of commercial activity) to the periphery; the fall is more gradual along main roads and land prices rise around secondary centres. Prices dictate land-use. Over time, land-use changes to conform to the price. In most Indian cities, for instance, the residential density in inner cities has decreased in order to make room for more remunerative commercial activity.

The poor who are incapable of competing in the land and housing market, are driven to illegal squatting, overcrowding in dilapidated housing or forced to live long distances from their workplaces on relatively inexpensive land.

As squatters, which lands can they occupy? Generally those that are either unsuitable or unattractive for real estate development: land subject to flooding; steep slopes of hills; marshy land; land under litigation; government-owned land; peripheral land; land reserved in the Development Plan for pub-

lic purposes but vacant for many years because there is no money to buy it. Thus, in the name of creating an orderly, hygienic and aesthetically pleasing environment, Town Planning, in fact, denies the poor access to even minimum authorized housing and basic services such as potable water, latrines, and drainage.

"Slum improvement" is offered to squatters as a palliative — the provision of communal water taps and latrines, paved pathways, open drains and street lighting. Even these services are provided on such an inadequate scale that they rarely improve the sanitation situation. This program does not reduce the intolerably high densities in squatter settlements. Above all, residents are not granted tenure and in the eyes of the law they remain unauthorized occupiers of the land. The original owner retains ownership of the land under "slum improvement" and has the option of expelling slum dwellers to marginal lands (after fulfilling certain conditions) and using the "improved" sites (with services) for real estate development, if the land occupied is or becomes prime land. This is done in the name of rehousing or rehabilitation. It is important to understand that the process of urban development gives very little urban land and services to a population that cannot compete in the land and housing market.

In this situation, the strategy of encouraging community participation and self-help efforts of the poor makes them responsible for their own affairs and leaves them to their own devices while conceding to them a minimal amount of the city's resources. This follows the dominant ideology which sees the poor as responsible for their own plight. In official strategies, therefore, the onus of improving their living conditions is put on the poor. And while appearing to satisfy their needs, the strategies,

in reality, reinforce conditions that serve the interests of developers and dominant groups.

This is not to deny the importance of community participation and self-help in improving living conditions for the poor. There are a number of Third World cities that have demonstrated the advantages low-income communities gain when they organize themselves. But they have also shown that there are several factors external to individual settlements which facilitate or arrest the success of self-help efforts and united action by the people. These factors become apparent when the phenomenon of squatter settlements is analyzed in the context of the wider processes of urban development and market forces in which the deprivation of the poor is rooted. Unless urban development strategies are cast in a manner that paves the way towards social justice by making interventions that bring greater benefits to the poor and lead to equitable distribution of a city's resources, the strategy to encourage community participation and self-help efforts of the poor will remain a tool for their exploitation. ■

Meera Bapat is an architect, urban planner and sociologist who has spent most of her career studying housing in squatter settlements in Pune, India.

In Brief

Register Now!

The Fifth International Conference on AIDS to be held in Montreal, Canada from June 4-9, 1989, will be the scientific event of the year for those concerned about the HIV infection and its consequences. Over 10 000 medical and social scientists, policy makers, educators, health-care workers, community leaders and students from throughout the world will be attending. The Honourable Kenneth Kaunda, president of Zambia, will be opening the conference.

If you want to attend, register as soon as possible. The number of participants may have to be restricted to avoid overcrowding. The deadline for submission of abstracts is February 1, 1989. The Fifth International Conference on AIDS is being organized by IDRC, WHO and Health and Welfare Canada.

For more information about the conference programme, accommodation, registration and abstract forms, fill in the attached postcard or write to:

V International Conference on AIDS
Secretariat: Kenness Canada Inc.
P.O. Box 120, Station B
Montreal, PQ
CANADA, H3B 1J5

Funding for Development

Some useful sources for those wishing to further their training:

Study Abroad XXV published by UNESCO lists international and national scholarships and courses in more than 126 countries. This book is available in all of IDRC's regional offices as well as from UNESCO, 7 Place de Fontenoy, 75007 Paris, France.

The Association of Universities and Colleges of Canada (AUCC), 151 Slater St., Ottawa, Canada K1P 5N1, produces an information package on specific graduate programs in Canadian universities. The AUCC also produces a *Directory of Canadian Universities*, a copy of which can be found at all Canadian diplomatic missions.

Students from Commonwealth nations can refer to the *Scholarships Guide for Commonwealth Post-graduate Students*. The catalogue lists universities by country and indicates scholarships, grants, loans and

assistantships open to graduates of Commonwealth universities who wish to undertake postgraduate study or research at a Commonwealth university outside their own country. The *Scholarships Guide* is produced by the Association of Commonwealth Universities (ACU), John Foster House, 36 Gordon Square, London, England WC1H 0PF. The ACU also publishes *Financial Aid for First Degree Study at Commonwealth Universities* and offers a free Personal Information Service which will provide students with information papers on postgraduate study in Australia, Britain, Canada and New Zealand. ACU and the Commonwealth Secretariat co-produce *Research opportunities in Commonwealth developing countries*. It provides information about research areas in universities of developing Commonwealth countries and indicates whether the universities are currently offering opportunities to graduate students and academic staff. It also describes the research undertaken in large, Commonwealth, non-university research institutions.

The Faculty of Medicine at the Catholic University of Louvain (MEDEVUC) in Brussels, Belgium has compiled a list of universities in Africa, Asia and Latin America which undertake medical research and offer training and participate in exchanges. MEDEVUC can be reached by writing to: Faculté de Médecine UCL, 52 Avenue E. Mounier, B-1200 Bruxelles, Belgique.

Minisis Comes Home

It's been a long road from Canada to Mexico, but after ten years of meeting in different parts of the world, the MINISIS Users Group, came home to Ottawa last September.

Over 150 delegates from 32 countries who use MINISIS (a computer software program) to manage textual and bibliographic data, gathered to share information about their applications, problems and successes, to learn how to use the software to its fullest potential and to make suggestions on MINISIS' future.

The MINISIS software package was initially designed by IDRC to computerize libraries and information centres in Third World countries. But many organizations in the developed world have also begun to use it. Users range from the State and Sport Commission of China and the Universidad Autonoma Metropolitana in Mexico to the World Bank.

MINISIS is an attractive program because it is both adaptable and affordable. The system, which runs on minicomputer equipment (the Hewlett Packard 3000 series) eliminates the need for larger and more expensive mainframe computers. And because MINISIS is so flexible, it can easily be adapted to a wide range of languages. At the moment MINISIS speaks 10 languages including Thai, Arabic and Chinese.

"Its ability to handle Arabic characters has been the most important element in our choice of MINISIS. There are no other programs which can answer this language need," said Mohammed Gasmi of the Documentation and Information Centre of the Arab League.

But despite all the improvements which have been made to the system over the past 10 years, Terry Gavin, the associate director of the IDRC Information Sciences Division which designed MINISIS, says if MINISIS is to continue to evolve and remain viable it has to adapt to changing technology. The number of users is growing at 20 to 30 percent per year and these users are making great demands for enhancements to the system.

IDRC wants to improve MINISIS so that it can run on smaller, faster and cheaper computers now available on the market. Among other new features MINISIS should be able to manage different types of data, including sound or image.

According to Gavin, if MINISIS is to last another decade, it has to be decentralized from Ottawa. IDRC has already set up two MINISIS resource centres, one in China and one in North Africa, and eventually a network of these centres will be able to support future releases of the software in developing countries.

The 10th meeting is a turning

point for the MINISIS system, says Gavin. "What we are proposing to do now is no less significant than what we did in the beginning. Hopefully, it will open up a whole new set of users."

Colleen Thorpe
Ottawa, Canada

Exporting Labour, Importing Food

Agricultural production in Lesotho is in crisis. This tiny country of 1.7 million people completely surrounded by South Africa imports almost 50 percent of its food requirements even though it was once a grain exporter.

Almost two-thirds of Lesotho's working men are employed in neighbouring South Africa. Their earnings generate over half the country's GNP. It is widely believed that the migration of Lesotho's workers caused the decrease in agricultural production.

Not so, says Manana Tuoane, a graduate student from Lesotho doing agricultural economics research at the University of Saskatchewan in Canada. Other factors such as drought, erosion of the already limited arable land, inappropriate technology and poor farming practices also contribute to the decline in production.

Manana Tuoane is studying the links between the large number of migrant workers in Lesotho and agricultural production. Her research, funded by IDRC and the Canadian International Development Agency, has taken her across three major districts in the Lesotho lowlands, where she interviewed some 350 farmers.

She found that even those farms with no male migrants to South Africa had experienced declines in productivity.

Designer Cattle

Fresh hope in the ongoing battle against African Trypanosomiasis now comes from an ancient source — cattle enjoying a natural resistance to the insect-borne trypanosome killers.

Researchers at the ten-nation African Trypanotolerant Livestock Network (ATLN) are specifically interested in molecules found in cattle blood that provide a first line of defence. The molecules (called antigens) and the genes that make them should help scientists and eventually cattle breeders select superior West African Shorthorn and Longhorn (N'Dama) individuals for breeding.

ATLN was set up in 1983 to find genetic solutions to a problem that devastates African livestock. According to 1982 Food and Agriculture Organization statistics, trypanosomiasis threatens an estimated 50 million cattle in a 37 nation area equivalent to one-third of the continent.

Trypanosomes normally seek refuge in wild animals. However, tsetse flies and other biting insects can inject them into domestic animals, including cattle, sheep, goats, pigs, horses and camels. Once infected, animals develop fever, lose weight and strength, may abort or become infertile and often die.

But some breeds perform fairly well even during persistent infections. Hardy N'Dama and Shorthorn cattle have had 2500 to 5000 more years to adapt to African trypanosomes than the more popular Zebu breeds. Zebu likely spread into Africa around 700 AD, coinciding with Arab invasions.

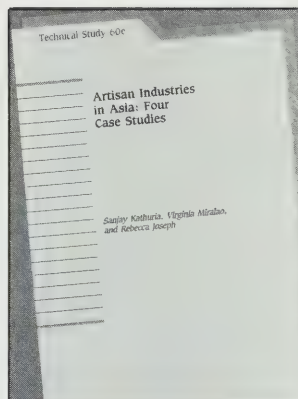
Trypanotolerant cattle number 10.5 million today — about 5 percent of all cattle in tsetse-infested Africa. Cross-breeding, 19th century pandemics, and prejudice against their small size have combined to keep breeding populations low.

ATLN seeks to reverse this situation. Research at its coordinating body, the International Livestock Centre for Africa (ILCA) in Nairobi, has helped pinpoint inherited traits that define trypanotolerance. A key characteristic is the ability to maintain high red blood cell levels during infections.

At the molecular level, desirable N'Dama possess a number of chemicals on the surface of red and white blood cells that distinguish them from Zebu. These chemicals could form the basis of blood tests aimed at selecting superior animals for breeding.

At the 16th International Congress of Genetics, in Toronto, Canada, ILCA geneticist Dr. John Trail described efforts to locate the genes behind the traits. If ATLN proves successful, breeders should be able to select not only the best N'Dama and Shorthorn individuals, but hardy Zebu animals as well using newly identified trypanotolerant genes as a guide. Genetic engineering may then enter the picture. Trypanotolerance may highlight Africa's first designer cattle.

*John Eberlee
Ottawa, Canada*



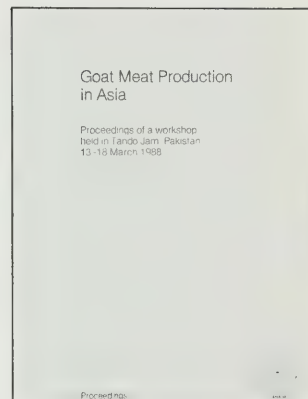
Artisan Industries in Asia: Four Case Studies

*Sanjay Kathuria, Virginia Miralao
and Rebecca Joseph
IDRC-TS60e, 89 pp.*

This book contains case studies on two important issues related to the development of artisan industries: the welfare of handicraft workers and the impact of high volume exports.

Workers' welfare and quality of life are the subjects of three papers from the Philippines and Indonesia. Until now, the response to severe unemployment, balance of payments and debt burden has been an almost exclusive emphasis on creating jobs and generating foreign exchange through labour-intensive industries. This bias has precluded a closer scrutiny of the quality of employment provided by the craft industries. This book examines the working conditions of workers, especially female employees, and puts forward a set of policy options to address problems in this area.

The second issue, the high volume of exports that Asian countries are now experiencing, is examined in a macro-economic context. Using data from India, the author of the fourth case study evaluates a wide range of international demand conditions that are having an impact on trade and forcing changes at the local level. Specific recommendations are made to increase exports and to improve the overall policy environment.



Goat Meat Production in Asia: Proceedings of a workshop held in Tando Jam, Pakistan, 13-18 March 1988

*Editor: C. Devendra
IDRC 268-e, 262 pp.*

This publication, the result of a 1988 workshop, focuses on all aspects of goat meat production in Asia. These include: breeding and animal diseases; the nutritional value of goat meat; methods of slaughter; processing techniques; consumer preferences and marketing. Case studies from Bangladesh, China, India, Indonesia, Malaysia, Nepal, Pakistan, Philippines, Sri Lanka and Thailand are presented.

Among their many recommendations, the 50 participants suggested the formation of a network on small ruminants and a regular goat news bulletin.

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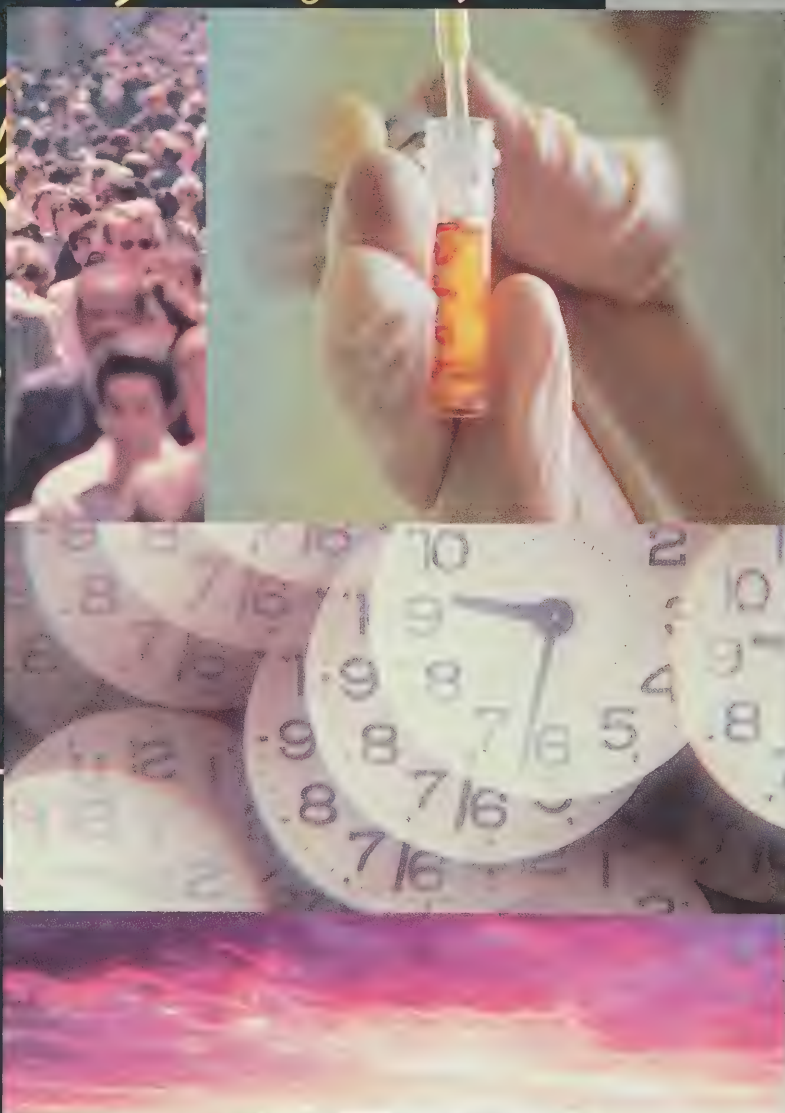
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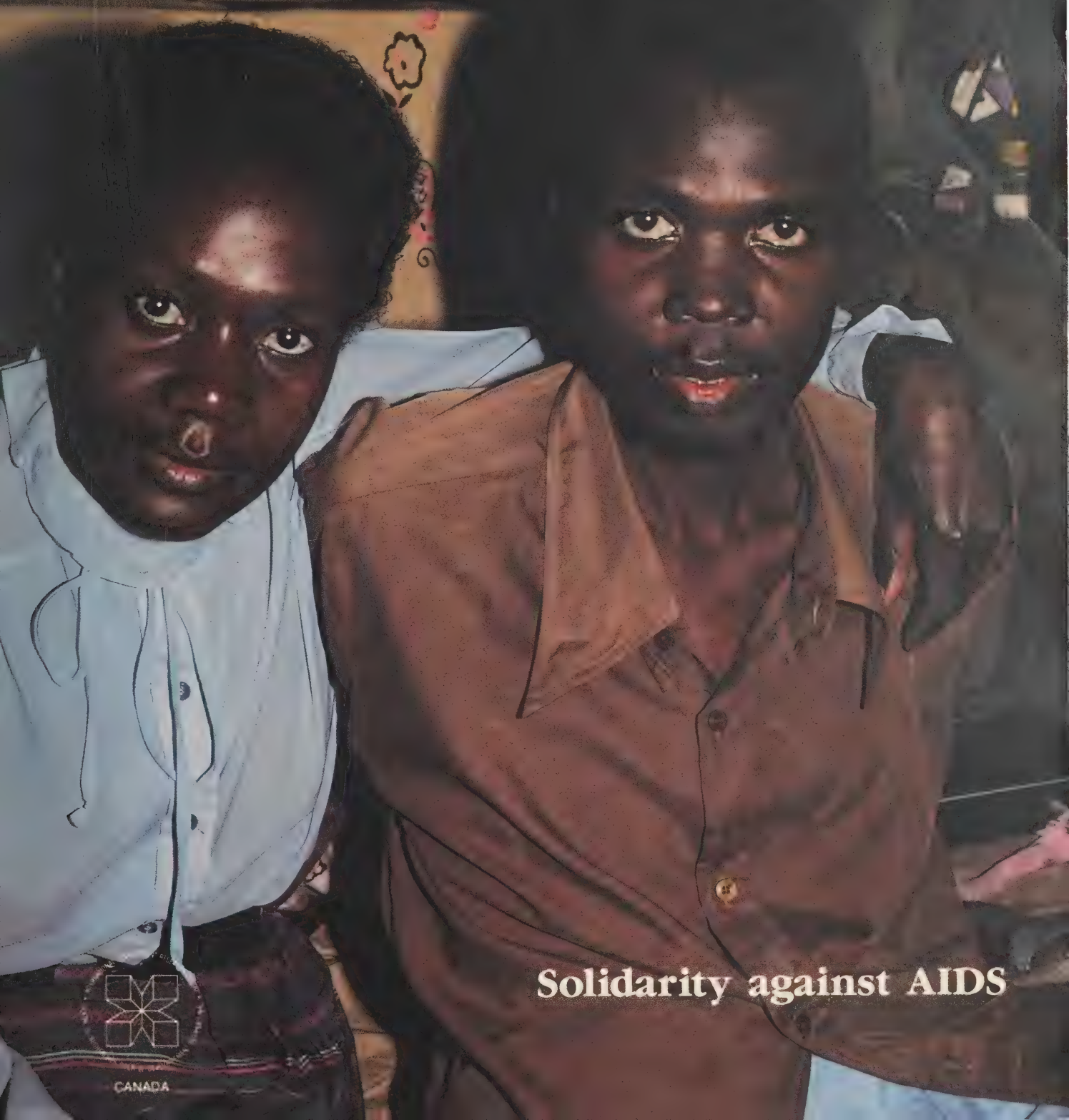
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VOLUME 18, NUMBER 2 — APRIL 1989

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THE
IDRC

Reports



Solidarity against AIDS



CANADA

Zimbabwe also exports meat to Europe

I wish to take issue with the article "Botswana's New Breed" (*Reports*, July 1988). The article states that "apart from South Africa, Botswana is the only Southern African country to export fresh meat to the European Community."

Zimbabwe has invariably been considered a central or southern African state. But whichever way one takes it to be, it is one of the developing countries exporting fresh meat to the European Economic Community.

Until recently, Zimbabwe had an export quota of 8100 tonnes which earned the country \$72 million. The EEC has just agreed to increase the quota by 22 percent to 9850 tonnes, which will increase the country's export earnings to \$87.8 million. The quota increase has been made possible by allocating the unused portion of the quotas of Swaziland, Botswana, Kenya, and Madagascar to Zimbabwe.

Zimbabwe has proved itself to be one of the few African-Caribbean-Pacific (ACP) states capable of meeting its quota for top-quality meat to Europe. This is quite an achievement given the past problems of foot-and-mouth disease and the need to limit exports in order to restock the national herd after the liberation struggle in the 1970s and the severe drought of the mid-1980s.

The Government has encouraged farmers, through various inputs and price incentives, to produce more beef for the export market. This market has been satisfied without affecting the local market.

I hope you find this success story to be of interest.

Ian Charles Mashingaidze
Department of Physical Planning
Masvingo, Zimbabwe

Sorghum spread on road for drying not threshing

I read with a great deal of interest the article by Gerry Toomey, "Sorghum as Substitute" (*Reports*, July 1988). Thanks for reporting on very interesting research, the results of which would be applicable to West and Central Africa.

However, I would like to point out an error in the photo caption at the bottom of page 20 which says, "In rural India, the force of passing vehicles serves to thresh the sorghum before it is dehulled and milled." In my opinion, your reporter seems to have succumbed to the journalistic tendency for dramatizing the uncommon. In India, a majority of farmers thresh sorghum, millet and rice using cattle. The harvest is spread on a previously prepared threshing floor and the farmer's own and often borrowed draft animals, harnessed two to four head abreast, are marched in a systematic circular fashion to trample/thresh the harvest. A similar operation is performed using tractors where available.

In very few situations, such as the one shown in the photo, a few farmers and labourers with small quantities to thresh spread the harvest on the road not so much to thresh it as to dry it. Threshing by passing vehicles is incidental and a secondary objective at best. Power-driven threshing machines are slowly coming into vogue but are not yet a common sight in the villages.

Sanath R. Reddy
Regional Agricultural
Development Advisor
USAID
Abidjan, Côte d'Ivoire

More nutrition from pulped forage

In the July 1988 issue (Vol. 17, No. 3), you featured livestock. Forage-raising was shown to be a critical issue in this activity.

I am writing to suggest that farmers who are concerned with growing forage consider using a system known as green crop fractionation. In this system, the fresh forage is pulped and the juice is separated out. On heating the juice, a nutritious curd is recovered. The curd can be used directly in a wide range of foods and substantially boosts their nutritional value. The protein-fibre fraction from the processing can be fed to the animals either directly or after preservation and storage. This fraction is actually as nutritious for the animals as the starting forage since the pulping improves digestibility and compensates for the removal of some nutrients. The third fraction is the whey which can also be fed to animals or used to fertilize the land on which the forage is being raised.

We would be glad to provide more information to you and your readers on this process which effectively triples the amount of food produced on a plot of ground.

Dr Walter J. Bray
Technical Consultant
find your feet limited
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Forgive debt of countries that improve female literacy

We note the letter titled "Forgive debt but tie aid to population control" in the Letters section of the April 1988 issue of *Reports*. From our experience, and bearing in mind the conditions of the rural poor and those living in slums, we do not believe a government policy of "population control" would be of benefit because it can lead to inhuman happenings with officials seeking to meet "goals".

The way to link debt forgiveness with aid is to ensure that the countries concerned prove that female literacy rates are increased. Associated with literacy is a drop in infant mortality and, with this decline, malnourishment percentages decrease.

With more children living, the number of births decreases. Thus, a reduced population is achieved—with an increased quality of life for the poor.

We appreciate receiving *Reports* as we live in an isolated and extremely poor part of western Orissa in India. We find many of the articles encouraging to our own work.

L. Gunanidhi
Trustee, New Hope
Orissa, India

Unsoaked beans cook faster

I was interested to note that H.S. Gurudas in his letter captioned "Beans in India" (July 1988) referred to soaking beans overnight to make cooking easier. In our project, as a preliminary to teaching bean-soaking as another method of economizing on fuel use (besides improved stoves), we did a series of six trials comparing the length of time taken to cook beans pre-soaked and unsoaked. The idea was to devise a convincing demonstration for our trainees.

However, in half the trials the unsoaked beans were cooked before the soaked beans and when the reverse was true, the difference was negligible. The beans used were two types of kidney beans (*Phaseolus vulgaris*), red ones and white ones. I would appreciate your readers' comments on this.

The practice mentioned of cooking beans slowly in the embers "in fireplaces made of clays" seems to be very economical. It is one which we will also investigate in relation to local practices.

Anne Sefu
Coordinator, Morogoro Fuelwood
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Christian Council of Tanzania
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Morogoro, Tanzania

Cover photo: Living with AIDS. Ugandan nurse Rose Amto, who works for an AIDS support group, visits client John Kasirye at his home in Kampala. Both are HIV-positive. See p. 6.



Photo: Gerry Toomey/IDRC.

Reports

THE IDRC

CONTENTS

Letters

2

OUR THEME THIS ISSUE: SOLIDARITY AGAINST AIDS

Towards a global consultation on AIDS

4

AIDS defies a purely medical solution. Behavioural research ranks high on the agenda of developing country scientists preparing for the Montreal conference.

A snake in the house

6

A young self-help agency in Uganda has little money and few drugs to work with. But it has taken on the difficult job of counseling and caring for people with AIDS. *By Gerry Toomey.*

Robbing the cradle

10

The risk of mother-to-baby transmission of AIDS is less than earlier suspected, but it does seem to depend greatly on the infected mother's health. *By Gerry Toomey.*

From a trickle to a flood

11

Radio, newspapers, TV, posters, drama, song — all information channels are being used by Kenya to "help crush AIDS". *By Odhiambo-Orlale.*

For more information . . .

12

Sources of information on AIDS, including several data bases and periodicals.

Visual AIDS

14

With no cure or vaccine, AIDS prevention relies on information, education, and communication. A sampling of messages from around the world.

Mussel rafts of Chiloé

16

For the residents of a Chilean island, mussel farming is lucrative new business. *By Oscar Chaparro.*

Rio's shaky shantytowns

18

Soil mapping will help prevent the mud slides and rock slides that now threaten Brazil's poor, hillside "favelas". *By Claude Archambault.*

What lovely teeth!

20

Kenyan youngsters use a wooden chewstick called a "mswaki" to clean their teeth. It makes for fewer cavities and is good for the gums and tooth roots. *By Denis Marchand.*

Cleaning water with sunshine

21

The idea being tested in Lebanon is incredibly simple: the sun's ultraviolet light can kill harmful bacteria in drinking water. *By Robert Bourgoing.*

Quinoa's comeback

23

The protein of this High Andes grain is of excellent quality. But there are still problems getting improved varieties into the farmers' fields. *By Robert Inness.*

Honey from the treetops

24

Research joins ritual in safeguarding the livelihood of Malaysia's honey gatherers of the forest. *By Janet Durno.*

In brief

26

News and trends in international development.

New releases from IDRC

27

The IDRC Reports is published quarterly by the International Development Research Centre (IDRC) of Canada. Its aim is to keep an international readership informed about the work IDRC supports in developing countries, as well as other development issues of interest. The magazine is also available in French as *Le CRDI Explore* and in Spanish as *El CIID Informa*.

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TOWARDS A GLOBAL CONSULTATION ON AIDS

No other disease in modern times has had as global an impact as AIDS. This fatal syndrome has confounded modern science, yet spurred unprecedented international cooperation.

Acquired Immune Deficiency Syndrome was first recognized in 1981. Less than three years later, the causative agent, human immunodeficiency virus (HIV), was discovered. Since then, scientists have

laboured to understand both the syndrome itself and the virus that causes it.

Much has certainly been learned. Between 1982 and 1984, the scope of the pandemic was outlined, the elusive HIV virus was isolated, its targets in the human body were identified, and screening tests were developed.

The earlier history of medicine, too, had given us reason to be optimistic. Science had already been successful in developing vaccines against a number of viral diseases

such as smallpox, measles, rubella, polio, rabies, and hepatitis B. Indeed, smallpox was eradicated from the world with the help of an effective vaccine.

By 1988, though, it was apparent that the fight against AIDS would be more difficult than initially thought. Current scientific knowledge does not offer much hope for the development of either a cure or a vaccine within the next 5 to 10 years.

Efforts to control the spread of AIDS are hampered by various factors, especially the difficulty in changing human behaviour and the nature of the virus itself. People may be increasingly aware of the dangers of having multiple sex partners, for example, but this knowledge may not be sufficient incentive for some individuals to stop such high-risk behaviour.

As for the virus itself, some of its traits conspire to make the development of a vaccine a daunting task. For instance, the virus is able to "hide" within the very cells of the body that are needed to combat disease. HIV also mutates quickly, that is, continually alters the composition of its surface proteins. From the researcher's point of view, it is a fast-moving target.

As of November 1988, the worldwide number of reported AIDS cases was greater than 120 000. The official data are no doubt incomplete and do not provide an accurate picture of the number of asymptomatic people already infected with the virus and likely to develop AIDS in the future. Nonetheless, the growing monthly statistics give reason for global concern. The AIDS pandemic not only poses a unique health problem but also presents a challenge to progress made in other areas of human life—economics, social harmony, and culture.

The threat of AIDS has mobilized the world's scientific community to share their knowledge in a global counterattack. A multitude of experiences and the results from thousands of AIDS-related investigations have been presented at national and international conferences and workshops. Tensions over the origins of AIDS and the validity of serosurveillance data have eased and a true collaborative spirit is now emerging.

Next June, the V International Conference on AIDS will be held in Montreal, Canada. What will be the impact of this meeting and how will it differ from preceding ones? What are the research priorities of the developing world and will they be articulated? These and other questions occupy the thoughts of numerous

PREPARING FOR MONTREAL

From all over the world, they will converge on Montreal next June—biomedical researchers, clinicians, epidemiologists, lawyers, social workers, policymakers, and communicators. A projected 11 000 people will participate in the V International Conference on AIDS to listen and exchange their latest data and experience in the fight against this deadly syndrome.

For the first time in this series of annual international conferences, AIDS will be approached in a holistic fashion, integrating the biomedical, social, and human dimensions of the pandemic.

IDRC—a sponsor and organizer of the Montreal conference along with Canada's Ministry of Health and Welfare and the World Health Organization—has made a commitment to make this world meeting particularly useful to the developing countries. To begin with, the Montreal program will include a special international module focusing on the epidemiology and impact of AIDS in the developing world. Secondly, regional preconference planning meetings were held in Kenya, Benin, India, and Brazil to seek the counsel of the developing country researchers regarding the conference program. (See article on this page.) And finally, a special unit has been set up to coordinate travel support of Third World delegates.

IDRC's *raison d'être* is to fund and support the work of developing country researchers in both the social and natural sciences. Its policy has always been one of responsiveness to research needs as expressed by developing countries themselves. To date, our modest support for, and experience with, AIDS research has mainly been in East Africa because that is

the region from which the requests have emanated. This work has focused mainly on the problem of mother-to-child transmission of HIV and subsequent development of AIDS. (See page 10.)

As institutions around the world begin to incorporate AIDS projects into their research agendas, numerous new requests for support—mainly from African countries, but several from Asia and Latin America—are being received by IDRC. About two dozen of these are under consideration.

In the absence of a vaccine or cure for AIDS, human behaviour must be altered to minimize the risk of HIV transmission. To convince people to do this—via information, education and communication programs—a better knowledge of human sexual behaviour is needed. For this reason IDRC has adopted an AIDS policy that makes research on human sexuality and behaviour its priority.

IDRC hopes that increasing knowledge in this area of human life will be a useful contribution to the fight against all sexually transmitted diseases. As usual, we will depend on the ideas and commitment of those women and men in developing countries who are motivated by a belief that solutions can be found to even the most intractable of problems.

In the following articles on AIDS, you will find useful information and, I hope, extra motivation to push back the frontiers of knowledge and help end the AIDS pandemic. ■

*Ivan L. Head,
IDRC President and Chairman
of the Steering Group,
V International Conference on AIDS*

Blood samples destined for cold storage and later HIV testing are labeled at the University of Nairobi's medical microbiology lab. Much work here focuses on the link between HIV infection and other sexually transmitted diseases.

Photo: Gerry Toomey/IDRC



individuals and groups concerned with the AIDS pandemic.

In preparation for Montreal, the conference organizers held a series of regional planning meetings—in Kenya, Benin, India, and Brazil. Developing country researchers were consulted on how the Montreal meeting might best address the needs of their countries. The decision to seek such advice reflects the organizers' commitment to a collegial approach and a belief that research priorities must be set by countries themselves.

Here are some of the recommendations and thinking that emerged from these consultations:

PARTICIPATION AND SPONSORSHIP

- Participants in all four preconference meetings agree that scientists from developing countries should be strongly represented in Montreal. Having such people make presentations not only at the numerous workshops and panels but also at plenary and other major sessions is a high priority.
- Block funding, whereby donor agencies contribute directly to the conference, is one way to support Third World participation. Funds earmarked for developing country participants should be adequate to cover not only those presenting papers but also policymakers and auxiliary health workers at the community level. Such personnel may not have papers to present, but their representation at the conference is extremely important because of their direct involvement in AIDS prevention and control.
- For those conference participants lacking experience in the preparation of abstracts of papers, assistance could be provided by local institutions and possibly donor agencies.
- Preconference workshops could be sponsored by national institutions and donor agencies. These would allow presenters to pretest the content and delivery of their presentations in an informal setting—a kind of dress rehearsal. This form of peer review would be useful in polishing final presentations.

RESEARCH PRIORITIES AND TECHNICAL NEEDS

- In the past, the biomedical and epidemiological aspects of AIDS have received most of the emphasis at major conferences. Without a vaccine or cure, how-

ever, AIDS control efforts will depend heavily on reducing high-risk human behaviour. At all of the planning meetings it was therefore felt that the AIDS-related work of social and behavioural scientists must be emphasized and expanded. Their participation in the Montreal meeting should be strongly supported. Social and behavioural research—on sexual practices and beliefs, for example—is highly sensitive, culturally speaking. Yet it is vital to the design of effective prevention strategies for specific target populations.

- Establishing counseling services for those infected with the AIDS virus and those caring for them is an important pursuit. Developing countries, with a tradition of caring for persons with AIDS at home, would have much to contribute, and learn, in this area.
- Continued research is needed to develop therapeutic drugs. The efficacy of alternative treatments, including herbal compounds and traditional medicine, also needs to be investigated.
- Technological research is needed to develop HIV diagnostic tests. These must be affordable to developing countries, as well as sensitive, reliable, and stable under tropical conditions.
- Quality control of blood products is of vital importance. Along with suitable screening technologies, a strengthening of basic laboratory facilities and upgrading of personnel are required.
- The AIDS pandemic has highlighted the need for a general strengthening of the health infrastructures of developing countries. The need to integrate AIDS prevention and treatment into existing primary health care systems was raised in several preconference planning sessions.
- Research on the link between AIDS and

other tropical and endemic diseases such as tuberculosis, as well as malnutrition, is essential. Genital ulcers and multiple sexual partners have been frequently cited as contributing to the risk of acquiring HIV. Further research is needed in these areas. It is also important to determine why heterosexual intercourse is apparently more efficient in transmitting the virus in some countries than in others.

- AIDS mortality rates, prevalence, incidence, and distribution (the domain of epidemiologists) need continued monitoring. This is important not only for surveillance of the current AIDS situation, but as a warning of any significant changes in transmission patterns. Developing countries require financial, human, and technical assistance in this area.
- Finally, several other research topics of interest to developing countries and identified at the planning meetings are worthy of mention: mother-to-child transmission of HIV, including the possible role of breastfeeding; immunization of HIV-infected children; the role of family planning programs in AIDS prevention; the role of various forms of contraception, such as condoms and the pill, in either facilitating HIV infection or protecting against it; and the economic impact of the disease.

Overall, two clear messages emerged from the regional planning meetings. First, global discussions of the AIDS pandemic should place more emphasis on human and ethical issues. Secondly, the developing countries are ready and willing to take the initiative in their national campaigns against AIDS.

If the hopes of those AIDS researchers who participated in preconference planning sessions are realized, the Montreal conference will be a major success. ■

A SNAKE IN THE HOUSE

LIVING WITH AIDS IN UGANDA

Uganda has the largest cumulative number of reported AIDS cases of any African country. Though gravely short of resources to deal with the epidemic, the government has an open and frank policy on the problem. Outside the country, this has begun to translate into international assistance for control and prevention. Inside, it has created fertile ground for the emergence of a grass roots movement to deal with the daunting task of care and counseling of the growing number of people with AIDS.

GERRY TOOMEY

Frail and thin, John Kasirye lies resting in the small, dim bedroom of his two-room house in Mulago village, a central neighbourhood of Kampala, the capital of Uganda. Outside his window, little children play beneath leafy banana trees, oblivious to the fact that their 32-year-old neighbour, a truck driver, has AIDS.

For people with Acquired Immune Deficiency Syndrome, the prospect of an early and painful death is tragic. What adds to the burden of thousands of Africans like Mr Kasirye is their extreme poverty, the shortage of medicine, and, perhaps worst of all, desperate worries over the fate of their children.

"Before being sick, I had four wives," laments Mr Kasirye. Three have left him, and six of his seven children have had to go and stay with a grandmother. Some of his sisters help to care for him now. His remaining wife has also tested positive for the AIDS virus.

Above the foot of Mr Kasirye's bed on a short clothes line hang half a dozen freshly washed pairs of underwear, a testament to his illness. "I can eat and drink," he continues, "and I can still walk, but I don't do so because I've been having diarrhea."

Too weak to visit the Mulago Hospital AIDS clinic even though it's not far away, Mr Kasirye is attended by a nurse, Rose Amito (not her real family name), who works for a local self-help agency, The AIDS Support Organisation, or TASO. She also has AIDS. (See "Rose of Kampala", page 9.)

Today nurse Amito is accompanied on her rounds by a West German doctor and a Canadian editor. "I used to operate my own vehicle," Mr Kasirye tells his visitors. "But I fell ill and soon didn't have the strength to change a tire." So he sold the vehicle, hoping to buy another once he was feeling better.

But Mr Kasirye's diarrhea and other symptoms persisted. He was diagnosed as

having AIDS—or "slim" as the Ugandans call it. Without work, he was forced to spend the cash from the sale of the truck to support the family. The funds have run out. "I have no income and no hope now," he says in the softest of voices.

Rose Amito visits Mr Kasirye about once a week. She provides basic medication such as aspirin and antidiarrheals, plus food, soap, and kind words. Lately he has had access to the drug Imodium and to an experimental herbal treatment. Imodium helps control diarrhea caused by intestinal infections such as cryptosporidium.

But drugs are usually in short supply. "There is a tablet, Nizoral, that is very difficult to obtain," explains Ms Amito. "They used to give it free in the clinics, but now we can't get it." Nizoral is used to treat oral thrush, a fungal infection of the mouth and throat common in AIDS patients. Without the drug, says Ms Amito, patients with thrush are soon unable to eat, which further weakens them.

When Nizoral is available, it is very expensive. A full course of 20 tablets would cost about five months' salary at minimum wage. As for the drug AZT, recognized as effective against the human immunodeficiency virus (HIV) itself, it is not available in Uganda. Even if it were, it would be far too expensive for the health system to supply.

Poverty here is both personal and institutional. With the Ugandan economy in a shambles, the public health care system is underfunded and overburdened. For every 21 000 patients, for example, there is only one doctor, according to the London-based Panos Institute. In Western Europe, the figure is 470 patients per doctor.

Because salaries are so low, even the doctor who heads Mulago Hospital is forced to grow a vegetable garden to make ends meet. The flagging economy has driven some 200 Ugandan doctors and trained technical staff to seek work in Saudi Arabia and southern Africa. With no foreign exchange, the hospital has at times had to barter with other countries: pineapples in exchange for some of the 60 essential drugs it needs. And for long periods, Mulago Hospital was without running

water. Staff and patients alike became water bearers.

For Uganda's 15.5 million people, the AIDS epidemic has struck just as the nation is beginning to regain its sanity and security after many years of bloody civil strife and genocide. During the regimes of Idi Amin and Milton Obote, in the 1970s and first half of the '80s, hundreds of thousands of Ugandan civilians and soldiers were slaughtered.

President Yoweri Museveni, whose rebel forces eventually defeated the government army, came to power in January 1986. He is credited with bringing a measure of peace and security to a devastated Uganda. But the economy is still plagued by a huge foreign debt, lack of foreign currency, high inflation, low wages, and impaired agricultural productivity and exports.

To this string of economic ills must be added the long-term toll of the growing AIDS epidemic. The syndrome mainly strikes a community's breadwinners—those between 15 and 40. "AIDS steals the young and most productive and loved members of the society," Dr Samuel Okware, director of the Uganda AIDS Control Programme (ACP), told an AIDS conference in Arusha, Tanzania, last September.

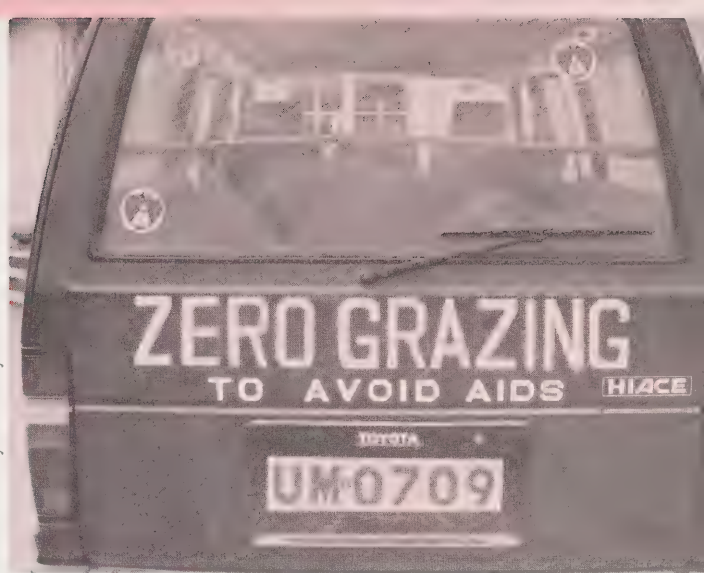
Uganda's AIDS program certainly has its work cut out for it. As of May 1988, the cumulative number of reported cases was 4734. By August the number had grown to 5508. But this is probably much lower than the actual number because it is only within the last year or so that a comprehensive national system for reporting AIDS cases using standardized forms has been in place.

In a June 1988 progress report, Dr Okware estimated the HIV infection rate, or "seroprevalence", at between 0 and 5 percent of rural adult Ugandans, with some areas still free of infection. Eighty-six percent of the country's population is rural.

For adults in Kampala, the infection rate is estimated at between 5 and 20 percent. In villages along trading routes, the range is 5 to 15 percent. More precise figures have come from surveys in Kampala. In one group of blood donors, the HIV infec-

*Prevention motto of
Uganda's AIDS
Control Programme.
The message is sexual
fidelity.*

Photo: Gerry Toomey/IDRC



tion rate was 14 percent, and among women attending a prenatal clinic it was 13 percent.

Other studies cited by the London-based Panos Institute, which has been closely monitoring the AIDS pandemic, report HIV-positivity rates in Uganda of 15 to 21 percent among blood donors and 20 percent among pregnant women.

"We have found no difference in seropositivity between ethnic or religious groups," Dr Okware told the Arusha conference. "Human tragedy and misery have descended on the faces of the poor and rich alike."

While AIDS may not select its victims according to class or religion, lifestyle plays a role. Uganda ACP studies, like those from other countries, confirm an increased risk of HIV infection for those with multiple sexual partners or multiple episodes of sexually transmitted diseases such as gonorrhea.

"The good news is that there are virtually no cases between the ages of 5 and 15," said Dr Okware. That age group makes up 30 percent of the population. As for infants, the seroprevalence and disease rates are not as clear because of difficulties with diagnosis. "However, we suspect that perinatal [occurring around the time of birth] transmission in our surveillance series could be responsible for up to 10 percent of cases. (See page 10.)

The number of AIDS cases is doubling every four to six months, according to the Uganda ACP. Globally, the pandemic is spreading more slowly, with a doubling time of about one year. Assuming a six-month doubling rate in Uganda, one could expect a cumulative total of about 300 000 cases by May 1991. That equals the number of people killed during the regime of Idi Amin.

Predicting the pattern of an epidemic, though, is risky, even for experienced epidemiologists. It may be, for example, that the alarmingly short doubling time in Uganda is more a reflection of recently improved reporting of the disease than of an explosion of new cases.

But the numbers for Uganda and other East and Central African countries do point clearly to a growing epidemic. Is the current problem in Uganda simply the tip of the iceberg? "A volcano might be a better

metaphor," says Dr Donald Sutherland, WHO's advisor to the Uganda AIDS Control Programme.

The Ministry of Health set up the ACP in July 1987 with WHO assistance. The program's job is to contain the volcano. Headquartered at Entebbe on Lake Victoria, a half hour's drive from Kampala, the ACP now has a staff of about 50, including four WHO experts. About 100 local health educators have also been recruited.

The ACP monitors the epidemic, provides statistics on the number of cases and infection rates, and carries out surveys and other research. It also runs a large public information and education program, screens the blood supply, operates test facilities, and helps to protect public health workers by supplying them with sterilizing equipment and gloves.

WHO's contribution to Uganda's control

program is the largest of its AIDS operations in the developing world. This is not only because of Uganda's need, but also because the political climate was right, says Dr Sutherland. "Uganda has taken a remarkable attitude towards AIDS. The policy of the Ministry of Health has been to be open."

The openness of the Museveni government—toward the Ugandan public as well as foreign scientists and journalists—is remarkable in light of the negative treatment, much of it unjustified, given the African AIDS situation in the international press over the last three years.

It has often been repeated, for example, that AIDS likely originated in Africa. This view is based on, among other things, erroneous analysis in the mid-1980s of old blood samples from Kenya and Uganda. The test results indicated a high rate of HIV

HOW AIDS IS SPREAD

The world pandemic of AIDS has several principal transmission routes. The human immunodeficiency virus (HIV) that causes the syndrome can be passed from one person to another during sexual intercourse, either vaginal or anal, heterosexual or homosexual.

HIV can also be gotten from a transfusion with contaminated blood or when intravenous drug users share hypodermic needles with an infected person. Infected mothers can pass the virus to their babies before, during and possibly after birth (though there is little evidence of transmission via breastfeeding). Ritual scarring of several people with the same knife or piercing instrument is also thought to carry the risk of HIV transmission.

In Africa, unlike Europe and North America, penetrative sex between a man and a woman is by far the most common transmission route. Cases of AIDS are about equally split between men and women. Surveillance work in Uganda suggests, for example, that 80 percent of people with AIDS contract-

ed the syndrome through a heterosexual encounter. Transmission through contaminated blood and from infected mother to child are largely responsible for the rest.

As for homosexuality, it is not generally believed to be a significant means of transmission in Africa. In one Ugandan survey, for instance, only three of 742 HIV-positive respondents said they had had homosexual relations.

For every reported case of AIDS in the world, there are likely a dozen or more people infected with the virus. Although these "seropositive" people appear healthy, they are capable of transmitting HIV to others. It is still not known what percentage of them will go on to develop full-blown AIDS or die. But one U.S. study indicates that up to 50 percent of those infected will develop the disease in 10 years. Some estimates are more pessimistic, suggesting that HIV-positivity is a death sentence, though one that may be postponed for many years. ■

infection, making it appear that Africa had harboured the AIDS virus for a long time and therefore was a likely geographical origin of the disease.

"When methods for testing blood for HIV antibodies improved, the early blood tests were discredited and it was accepted that AIDS was as new to Africa as it was to the United States and Europe," says a recent edition of *AIDS and the Third World*, published by the Panos Institute.

Such scientific error angered many Africans. For one thing, they felt they were being blamed for the international epidemic when in fact there was no evidence that Africa was the source. The "origins" debate flashed on and off in the international press, sometimes sparking charges of racism, and reinforcing the closed-door policies of some African governments. Uganda, though, followed a policy of openness and got on with the job of controlling the epidemic.

"We Ugandans believe that if a snake enters your house, you don't go and ask the snake where it came from," says Louis Ocheru, coordinator of the ACP's information, education and communication program. "Rather, your reaction would be, 'How do I get rid of the snake?' So, in Uganda, we don't discuss the problem of where AIDS came from, we discuss how to get rid of the beast."

Whatever the metaphor—snake or volcano—the fight against AIDS is an enormous and expensive task. But, as in other countries, it is just one of a number of competing health priorities. Parasitic diseases such as malaria, sleeping sickness, and schistosomiasis, as well as acute respiratory infections, diarrhea, and malnutrition, are also serious public health hazards in Uganda. And, like AIDS, they demand attention from a beleaguered and impoverished health care system.

This helps explain a phenomenon described recently by a Canadian development worker and former research scientist who worked in Africa for several years. AIDS experts from the Northern countries, he recalls, "ran around looking very serious" at the Arusha conference. They projected a great sense of urgency over the AIDS situation in Africa because of its relative gravity in their own country.

"Would we be seeing the extraordinary Northern interest in AIDS in developing countries if the syndrome were a problem only of developing countries?" asks the Canadian, who prefers not to be named. "Malaria is a good example. It has killed millions in developing countries in this century, but has attracted a disproportionately small and hopelessly inadequate percentage of Northern research resources. The malaria catastrophe continues, and it is not unlikely that human and financial resources for the fight against malaria are being diverted to AIDS. We shouldn't be surprised if such events are viewed with some cynicism."

The Uganda AIDS Control Programme has received only minimal funding from

the Ministry of Health. The money is simply not available. The government's policy of openness, however, has helped the country to attract badly needed foreign assistance, mainly from Europe.

Overall, though, funding levels are still grossly inadequate. The ACP estimates its yearly needs at about \$14 million (Canadian). Donors' pledges of assistance to its first year of operation amounted to about \$9 million. And only about \$3.5 million of that was actually received. By comparison, Canada, with less than half as many cumulative AIDS cases as Uganda, started up its Federal Centre for AIDS with 10 times that amount—\$36 million.

Cash shortfalls force the Uganda ACP to concentrate on the most critical priority—slowing the spread of the epidemic. In practice, this means concentrating on prevention work such as screening the blood supply, protecting medical workers, and educating the public. Protecting the blood supply alone eats up about a quarter of the ACP's budget.

But what about the work of counseling and caring for people like John Kasirye who are already ill with AIDS? For them, the existence of the prevention-oriented ACP is little consolation. The ACP has had to turn to church and other grass roots groups such as The AIDS Support Organisation—TASO—to at least provide moral support and basic care.

'HIV infection is threatening to split apart traditional family links.'

Nurse Amito and her two foreign visitors say goodbye to John Kasirye and return on foot to the TASO headquarters at Old Mulago Hospital. As they arrive, the black sky bursts and a tropical downpour begins to beat a steady hum on the corrugated metal roof.

Inside the office, it is tea time. TASO staff and a few clients sit around the office in quiet conversation. "You can't get AIDS from this cup" reads the inscription on a steaming tea mug.

The furnishings—three cabinets, three desks, and assorted chairs—have seen better days. A portrait of the late Pope Paul VI hangs on the wall. Near a window with blue and white checkered curtains is a small cabinet that holds a steel kettle, a tin of tea, and an antique telephone currently out of order. In a corner, a young woman with a sad face sits quietly reading a religious book. She is John Kasirye's wife.

"TASO sprang up among a group of volunteers who had been touched by the virus," says TASO Secretary Noerine Kaleeba, a founder of the fledgling agency and, in effect, the driving force behind it. "We want to convince the public that

being infected with HIV doesn't mean you're going to die today or tomorrow."

Set up in late 1987, TASO is the only nongovernment organization in the country concerned solely with supporting and counseling families affected by AIDS. Funding comes mainly from Action Aid, a U.K.-based agency.

When a prospective TASO client is known to have had contact with an infected person and also displays clinically recognized AIDS symptoms, an AIDS test called the ELISA is administered. A confirmatory "Western Blot" test is not usually performed because of the high cost. TASO provides pre- and post-test counseling and offers clients moral support. In cases of extreme poverty, food and clothing may also be given.

Caring for people with AIDS and their families, asserts Mrs Kaleeba, is too big a task for the country's social services or the hospitals to handle. TASO can help fill the gap. "It's usually possible for NGOs to deliver services without too much bureaucracy," she says.

"HIV infection is threatening to split apart traditional family links," warns Mrs Kaleeba. In some instances, people with AIDS are brought and left to die in hospital by their relatives who are no longer able to sustain the financial drain. And sometimes families abandon those with AIDS because they fear infection.

"There are also cases where the orphans of AIDS victims have not been taken care of by the many members of the extended family, as is usually the tradition. They fear that these children may also be infectious."

Nestor B., a TASO staff member who has AIDS, says the fate of his own three children is his gravest concern. "I can face the disease for myself and accept it," says the 36-year-old former journalist who prefers not to use his family name. "My worry is that my children, since they're being discriminated against by my brothers, will not be cared for. I see a bleak future for them." Nestor and other staff are now planning a TASO program to ensure the welfare and education of orphans.

In hospital, fear has led some staff to neglect AIDS patients, reports Dr Elly Katabira, co-founder of TASO and head of a weekly out-patient clinic for AIDS patients at Mulago Hospital. Sometimes doctors thought the situation was hopeless and "many patients were sent home and not given appointments to come back."

Since the clinic opened in April 1987, Dr Katabira has used it as a kind of laboratory for him and TASO staff to learn more about the disease. It has also served as a platform for educating his fellow physicians about humane treatment of AIDS patients.

After he and Mrs Kaleeba were trained in AIDS counseling in the U.K., they visited their Ugandan clients at home. They explained that it was safe for family members to care for those with AIDS and instructed them how to do it. "I discovered that the patients were much happier—they

were smiling and cordial," says Dr Katabira.

TASO's aim is to help people to live with AIDS and to give them hope and comfort. A positive attitude and healthy living — safe sex and no alcohol, for example—are promoted as ways to extend the lifespan of clients.

As with orphans, the widows of those who die of AIDS are of special concern to TASO. Even if they wanted to, it is difficult for them to find husbands who will accept them. Poverty and prostitution are sometimes their fate. TASO is therefore encouraging widows to start up small income-generating enterprises for financial security.

"By the way," says Mrs Kaleeba. "I'm a widow. I lost my husband to HIV and because of that I've come into contact with many widows."

With help from the Uganda ACP and an Irish volunteer instructor, TASO has been busy training new counselors and expanding its service. The head office covers the greater Kampala area and, by last autumn, 10 counselors were serving 112 client families. A second AIDS clinic has also been opened in Kampala for mothers and babies with AIDS.

TASO is also expanding outside the capital. It recently opened a second branch 130 kilometres southwest of Kampala. The U.S. Agency for International Development has promised funding to set up eight more TASO branches beginning this summer.

The emphasis on training more counselors is critical since blood donors who test HIV-positive aren't normally told of their status. The Ministry of Health feels that in the absence of counseling services, it serves no useful purpose.

With TASO now building its cohort of counselors, more and more cases of AIDS and seropositive individuals are being referred to it for counseling by hospitals. "The environment is now right for people to be told they are positive," says Dr Edison Mworozi, who is conducting research on mother-to-child transmission of AIDS.

In Uganda and other countries, both North and South, the medical and moral support of AIDS patients and their families has so far taken a back seat to prevention and control efforts. But as the pandemic grows, the number of people with AIDS will grow and, along with it, the need for direct support.

Organizations such as TASO are charting new waters. Their experience and expertise should be of increasing value to other countries and other support groups in the years to come. No country is too small to offer something in the fight against the AIDS pandemic, says Dr Okware of the ACP. And no country is big enough to have the complete solution to the AIDS problem. ■

Editor's note: John Kasirye, a TASO client, died of AIDS last October. He was 32.

ROSE OF KAMPALA

LIVING WITH AIDS

Rose and TASO client, William, a 23-year-old student with AIDS in the village of Kabalagala. She brings soap, eggs, simple medication, and friendly encouragement.



Photo: Gerry Toomey/IDRC

Rose Amito, a 29-year-old Ugandan nurse, has AIDS. Last year, after learning she was in the first stages of the disease, she joined the staff of The AIDS Support Organisation (TASO), a fledgling self-help group based in the capital city, Kampala.

For 10 years, beginning in 1977, Ms Amito worked as a registered nurse, first at a hospital in Eastern Uganda, then for the Institute of Public Administration in Kampala. In 1987 she decided to leave her nursing job to pursue a career as a midwife. She enrolled in a training program at the Mulago Nurses' Training School, but in March 1988, she fell very ill.

"I had fever and joint pains, especially in my knees," she recalls. "I wasn't able to move easily so I walked with a stick supporting me. And I had a cough which was not responding to treatment." She was admitted to hospital and, suspected of having AIDS, was given blood tests for HIV. "I spent two weeks in hospital and during that time, I was really ill and feeling so bad. There was no counseling available. It was terrible." She was discharged without knowing the results of her tests because they had not yet come back from the lab.

Back at the nurses' training school, she was shunned by other trainees because of her AIDS-related body rash. In the dormitory she shared with 20 other women, beds had been moved a "safe" distance away. Friends she used to take tea with avoided her.

She felt too weak to do her midwifery work and, besides, patients didn't appreciate it when she held their hand. She dropped out of school and went to live with her younger sister, who was more understanding of the problem.

"I was referred to TASO where I found colleagues—friends who had the

same problem." During a visit to a local AIDS clinic, her fears about her blood test were confirmed when she saw a simple inscription on her case sheet: HIV positive.

"At TASO, they comforted me and assured me that I wouldn't die immediately. I told them I wanted to go back home even though I knew very well that if I did so nobody else would bother about me and I would die there. So they discouraged me from leaving and told me *their* personal stories. They asked me to keep reporting back for the next few days.

"Each time I came to TASO I felt more at home. Because I was a nurse, they asked me if I could stay with them and care for some of the people who had been referred to TASO who really needed help. Some had open sores, others suffered headaches, and such things. I accepted their request and stayed on. So I have been dispensing the few drugs that the ACP (AIDS Control Programme) has assisted us with.

"At times I take sick friends home to stay with me in the small room I share with my sister because TASO doesn't have any place where we can admit them. One woman has some sores that need dressing but she can't do it herself because she is so weak. Here is somebody you know is very ill and maybe there is no treatment. But she needs someone by her side to at least comfort her and to do small things like give her a sponge bath.

"If these patients are taken to hospital, nobody is willing to touch them. Once somebody sees you've got a rash like mine, they keep away from you and leave you lying there. The hospital staff aren't very well informed about AIDS. But since TASO started holding workshops for them, there has been some slight attitude change." ■



This baby girl and her mother (not shown in photo) have come for pre-test counseling at a Kampala, Uganda AIDS clinic.

GERRY TOOMEY

As the world AIDS pandemic takes its course, the number of infants contracting the deadly disease is growing. Most AIDS babies do not survive beyond age two.

The problem is particularly serious in regions where transmission of the human immunodeficiency virus (HIV) is heterosexual and as many women as men are infected, such as sub-Saharan Africa. In Uganda, for example, babies account for about 10 percent of AIDS cases. According to the Panos Institute, which monitors the global pandemic, "in Rwanda in 1987, 35 percent of AIDS cases were in children, while Zambian health officials suspected that several thousand AIDS babies would be born to Zambian mothers in the same year."

In the vast majority of infant AIDS cases, mothers have unintentionally infected their babies either before, during, or after birth. This is known as "vertical" or "perinatal" transmission.

There are three major suspected mechanisms. First, during pregnancy the HIV virus in the mother's blood penetrates the placenta, infecting the child. Second, the virus can be transmitted during birth when the baby is in contact with infected vaginal secretions. Third, the newborn may become infected after birth, during close maternal contact such as breast feeding.

HIV has been isolated from fetuses in early pregnancy, from cord blood at birth, and from breast milk, lending credence to all three possible transmission routes. Scientists wish to determine the relative risk of transmission for each, as this will suggest possible courses of action to pre-

vent infection. In some cases, these options may be radical—for instance, deciding to terminate a pregnancy or not to have any more children.

In the case of breast feeding, there is very little evidence that this is a significant transmission route despite HIV having been isolated from mother's milk. (A few cases of transmission through breast feeding have been reported from Rwanda and Australia.) The World Health Organization has recommended breast feeding continue to be promoted and protected, even among HIV-infected women, because the benefits to the babies are thought to outweigh the risk of infection.

What are the chances of an HIV-positive mother infecting her offspring, and when and how does it occur? For scientists, these are tough questions because babies can harbour antibodies to HIV without necessarily having the virus itself. Fetuses passively acquire antibodies (including those specific to HIV), from their mothers during pregnancy. This is a temporary protection against diseases until the child's own defence system matures.

Since HIV infection is normally diagnosed indirectly, by detecting tell-tale antibodies to the virus, babies pose a special diagnostic problem until their passively acquired antibodies dissipate. This can take 12 months or more.

A new technique known as polymerase chain reaction (PCR), developed in the U.S., now makes it easier to detect small quantities of the virus itself rather than antibodies. Researchers have only recently begun to apply this promising technique in pediatric AIDS work.

Lower rates than expected

Despite the diagnostic problem, a number of studies have shed some light on perinatal transmission rates. Some U.S. work has suggested that as many as half of babies born to HIV-positive mothers may become infected and die. Fortunately, recent studies from East Africa indicate lower infection rates. Preliminary results of an IDRC-funded study by Kenyan and Canadian researchers in Nairobi, for example, suggest that about 30 percent of infants of HIV-infected mothers without AIDS symptoms are infected at birth.

"This is considerably lower than estimates from North America," reports one of the project leaders, Dr Frank Plummer of the University of Manitoba in Canada.

A critical factor in transmission seems to be the mother's health. A related study by Dr Plummer and his Kenyan colleagues suggests that the more advanced the state

ROBBING THE CRADLE

of the mothers' AIDS the worse off the babies are. They are more likely to die or suffer from "failure to thrive" (slow development including poor weight gain).

In Uganda, Dr Edison Mworozzi of the Makerere University Medical School is also studying mother-to-child transmission. His IDRC-supported research began in 1986 on an alarming note. In a screening of expectant mothers in the Kampala area, he found a "significant" HIV-infection rate of 13.5 percent.

Thirteen of 87 children (the study group) born of HIV-positive mothers died within the first two years. AIDS was not necessarily the cause of all the deaths. But the mortality rate for the group was 15 percent—"quite high" compared with 2 percent among the uninfected mothers' babies (the control group).

"With this kind of rate, you can see there's going to be a lot of problems with pediatric AIDS and this will have far-reaching implications when you consider that medical care and health services in developing countries are limited," says Dr Mworozzi. "A lot will be required to look after these children, especially since they may lose their parents to AIDS."

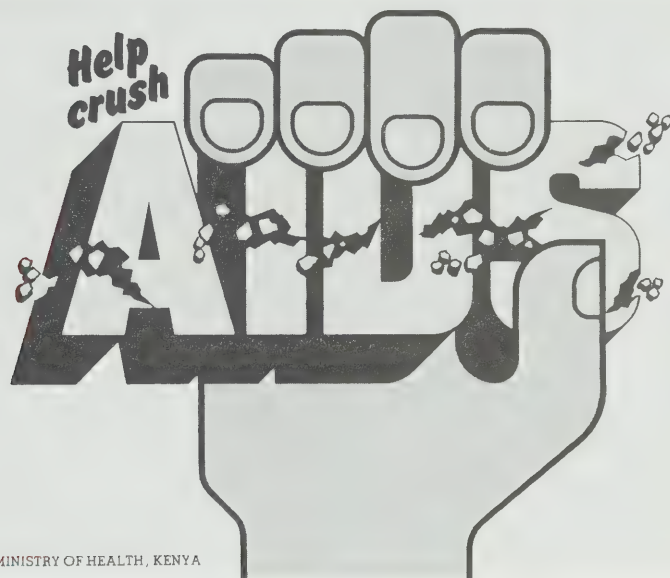
At the end of the two-year follow-up, a number of the surviving babies of HIV-positive mothers were tested for HIV antibodies. This was sufficient time for their passively acquired antibodies to subside. Two-thirds of the surviving babies had become seronegative—and presumably free of the virus.

An encouraging sign, says Dr Mworozzi, is that among the surviving children of HIV positive mothers, response to standard immunization against childhood diseases has been good. Dr Plummer's group also reports that vaccinations seem effective. This is good news given that some health care professionals fear that the act of immunizing an HIV-infected baby might actually bring on the diseases it is intended to fight.

Lastly, Dr Mworozzi found that the seropositive women in his study did not have a tendency to progress to the clinical symptoms of AIDS. (Some medical researchers have suggested that pregnancy might trigger AIDS in HIV-infected women.)

While research scientists unravel the biological complexities of mother-to-child transmission, the coming years will see a growing need for services to counsel mothers and to care for AIDS babies. A heavy burden will be placed not only on maternal and child health systems, but also on family planning programs. ■

KENYA'S AIDS INFORMATION FLOW: FROM A TRICKLE TO A FLOOD



MINISTRY OF HEALTH, KENYA

ODHIAMBO-ORLALE

In Kenya, as in some other countries, getting information on AIDS has, until recently, been nearly as difficult as finding a cure for the disease. Because of the extreme caution with which some government health officials and the print and broadcast media have handled the topic, one would have imagined it a bigger taboo to talk about AIDS than to actually contract the virus.

The Ministry of Health and the Kenya Red Cross began distributing AIDS posters to youth organizations, the Armed Forces, prisons, and public places in 1986. However, government officials remained conspicuously reserved on the subject of AIDS from February 1984, when the first case in Kenya was announced, to February 1987. During the same period, editors in the print and broadcast media handled AIDS information with extreme caution. It was "a sensitive matter".

But since the establishment of the 50 million shilling (CA\$3.7 million) national health campaign under the National AIDS Committee in early 1987, there has been a remarkable about-face in the approach to providing AIDS-related information.

When launching the national campaign in 1987, then Minister of Health Kenneth Matiba told journalists that "every person in Kenya must receive information on the prevention and control of AIDS." He maintained that an aggressive countrywide mass education program would be the most effective way to combat the spread of AIDS.

"We have to tell our people that there is no room for casual sex or promiscuity," said the minister. "We intend to use all

available channels of communication at our disposal to inform the public. This means the press, chiefs, the ruling party KANU (Kenya African National Union), youthwingers, officials, nongovernmental organizations, radio, television, schools, posters, and music."

Since the announcement, the country has been flooded with information on the deadly disease. The AIDS situation in Kenya—there were 2732 cases recorded and reported to the World Health Organization as of June 1988—is being discussed freely by print and broadcast media. There have been local and foreign news stories,

special features, editorials, and pieces by science and medical writers.

According to the Ministry of Health's national AIDS coordinator, Dr Francis Mueke, the government also has plans to advertise in the print media. "All Kenyans have the right to know all available information on AIDS," says Dr Mueke. "Each individual can make a decision to prevent transmission. So, let everyone know what AIDS is and how to prevent it."

The open dialogue has resulted in calls for both positive action to protect the general population and highly restrictive measures against people with AIDS.

BEST COMMUNICATION CHANNELS: RADIO AND WORD OF MOUTH

A recent survey by researchers in Kenya shows that radio and word of mouth are the two most important channels for communicating information about AIDS in that country.

The research team, which began its work in late 1987, was headed by Mrs Elizabeth Ngugi of the University of Nairobi's department of community health. It examined the knowledge, attitudes, and practices, with regards to AIDS, of 3639 urban and 3197 rural Kenyans.

A major outcome was a ranking of the effectiveness of various media. Radio was identified as a source of AIDS information by 66 percent of urban respondents and 61 percent of rural

respondents. "People", or person-to-person communication, ranked next, with scores of 65 percent (urban) and 58 percent (rural). Newspapers (54 and 38 percent) are also an important form of communication, followed by posters (32 and 22 percent) and magazines (22 and 13 percent). TV, at 11 and 5 percent, ranked last.

"Quite understandably, television ranks low because it is only available to a few sections of the community," says the report.

The researchers recommend, among other things, the production and broadcast of simple radio spot messages and radio lessons on AIDS.

Gerry Toomey

AIDS information: electronic and printed

In a letter to the editor in the *Daily Nation*, Kenya's leading daily newspaper, a contributor lamented that much has recently been written about the dreaded disease but little has been done to prevent it. He suggested that the government promote the supply and use of condoms. He also wrote that anybody who intentionally or unintentionally spreads HIV should be prosecuted.

Recently a Nairobi lawyer, A.D.O. Rachier, told an AIDS symposium that the government should pass legislation to confine people with AIDS so that they do not further spread the disease. He also suggested that laws be enacted making it mandatory for foreigners and pregnant women to be screened for the HIV virus.

The position of the World Health Organization (WHO) is that there is no public health rationale to justify isolation, quarantine, or any discriminatory measures based solely on the fact that a person is suspected or known to be HIV-infected. Since AIDS is spread through sexual intercourse and the exchange of infected blood, there is no public health hazard in casual contact, such as in the work place or social situations. WHO also says that screening travellers or demanding proof of seronegativity (absence of detectable antibodies to HIV) will not prevent the spread of AIDS.

In Kenya, one of the most debated AIDS topics has been the claims by local herbalists that they can actually cure the disease. "Over the past year, I have met six herbalists claiming to cure AIDS, but four of them had little or no evidence," says *Daily Nation* science columnist Otula Owuor. "But at least two of them seem to be doing something that at least improves the health status of the victims."

Leaflets, posters, and stickers

Since its inception, the National AIDS Committee, in conjunction with the Kenyan Red Cross, has handed out some three million leaflets, posters, and stickers in an attempt to educate the public about AIDS. The information is distributed by hand, inserted in newspapers and magazines, and posted in prominent places such as trading centres, bus-stops, and medical and educational institutions.

The three variations of the poster all convey a very simple message: "Spread facts not fear." It is printed in Kenya's two national languages, Kiswahili and English. Below this is an illustration of a hand grasping the words "Help crush AIDS" in block letters.

One version of the poster informs the public that AIDS, for which there is no cure, is not only a problem in Kenya but also around the world. The second version conveys the message that AIDS is contracted sexually, through blood transfusion, or by using contaminated syringes. The third says that people can reduce their risk of

contracting AIDS by limiting themselves to one sexual partner and avoiding prostitutes.

Plans are under way to produce posters with more graphics in order to reach the large population of Kenyans who are either illiterate or do not understand either of the national languages.

The National AIDS Committee, in conjunction with the Ministry of Information and Broadcasting, is using television and radio, which are state-run in Kenya, to further spread the anti-AIDS message. In addition to radio spot ads, a 30-part radio series is broadcast weekly in Kiswahili, English, and 18 local languages. Each half-hour program extols the virtues of responsible sex and is interspersed with a popular local song on the same theme.

The record, entitled "UKWIMI" on one side and "AIDS" on the flip side, was released by a Nairobi band, Them Mushrooms, in December 1987. The song, available on disk or cassette, warns the public against having sex with prostitutes, saying "Watch out! AIDS is dangerous and it can kill." The same song is also used as background music for a 30-second TV message about AIDS.

By last fall, about 2000 copies of the record had been sold or distributed free to major night clubs, radio and television stations of the Voice of Kenya, beer halls, and medical and educational centres throughout the country in an attempt to reach youth, who form the bulk of Kenya's population of 22 million.

In preparation for the first World AIDS Day last December, the National AIDS Committee prepared a 30-minute film documentary. This will be made into a video to be distributed to special interest groups in the country. The AIDS Committee also intends to hold seminars, symposia, and workshops.

For the general public, the AIDS Committee has also begun to use poetry and drama festivals to transmit its message on AIDS. Recently, a high school in Nyeri town, about 100 kilometres from Nairobi, staged a play in Kiswahili called *Tone Kwa Tone (Drop by Drop)*, produced and directed by a teacher, Joseph Warungu. It became the talk of the town and even of the district after its debut. It later received 17 awards during the provincial drama festival.

Commenting on the information role of the play, Dr Mueke said: "Mass education on AIDS is the only avenue remaining to combat this killer disease which is increasingly marching along our frontiers. This play has a tremendous impact and more people countrywide could benefit from it."

Odhiambo-Orlale is a journalist with the Daily Nation, a newspaper published in Nairobi, Kenya.

Along with the proliferation of information on AIDS, there has been a growth in the number of AIDS information services, in either electronic (online or optical discs) or printed format. The following are just a few of the many useful sources available

Electronic

- **AIDSLINE:** This new online data base is part of the Medical Literature Analysis and Retrieval System (MEDLARS) at the U.S. National Library of Medicine. It is a bibliographic file focusing on biomedical, epidemiologic, social, and behavioural literature, from a variety of published documents. Contact: MEDLARS Management Section, Bibliographic Services Division, National Library of Medicine, 8600 Rockville Pike, Bethesda, MD 20894, U.S.A.; tel. (301) 496-6193.
- **Compact Library: AIDS:** This is an optical disc (CD ROM) available from the Medical Publishing Group, a wing of the New England Journal of Medicine, in the U.S. It contains several data bases: the AIDS Knowledge Base electronic textbook produced by the San Francisco General Hospital; the MEDLINE AIDS subset provided by the U.S. National Library of Medicine; the AIDS Data Base from the U.K.-based Bureau of Hygiene and Tropical Diseases, which is a bibliographic system containing citations and abstracts of documents from 1984 on, from around the world; and full text articles from key biomedical journals. Contact: The Medical Publishing Group, Massachusetts Medical Society, 1440 Main Street, Waltham, MA 02154-9902, U.S.A.; tel. (617) 893-3800.

Printed Matter

A number of magazines, newsletters, journals, and bibliographies are particularly of interest to readers in developing countries:

- **World AIDS**, a new magazine published by the Panos Institute in cooperation with the Bureau of Hygiene and Tropical Diseases. Contact: The Panos Institute, 8 Alfred Place, London WC1E 7EB, U.K.; tel. (01) 631-1590. The Panos Institute, in collaboration with the Norwegian Red Cross, also recently published its third and final edition of *AIDS and the Third World*, an interdisciplinary dossier described by Panos as "a comprehensive global overview of AIDS".
- **IPPF Open File**, a biweekly publication with an informative AIDS section summarizing material from newspapers and other documents, published by International Planned Parenthood Federation, International Office, Regent's College, Inner Circle, Regent's Park, London NW1 4NS, U.K.; tel. (01) 486-0741.
- **Activities Update**, published by the Global Programme on AIDS (GPA), World

Health Organization (WHO), 1211 Geneva 27, Switzerland; tel. 91 21 11.

- *AIDS Health Promotion and Exchange*, a quarterly newsletter for those planning, implementing, and evaluating AIDS health promotion programs, published by GPA. See address above.
- *AIDS Technical Bulletin*, a subset of the AIDS data base from the Bureau of Hygiene and Tropical Diseases, published by GPA. See address above.
- *AIDS Action*, the international newsletter for information exchange on AIDS prevention and control, published by AHRTAG, 1 London Bridge St., London SE1 9SG, U.K.; tel. (01) 378 1403.
- *AIDS: an International Bimonthly Journal*, published by Gower Academic Journals, 1201 Locust St., 2nd floor, Philadelphia, PA 19107, U.S.A.; tel. (215) 790-2266.
- *AIDS Targeted Information Newsletter (ATIN)*, abstracts and critical comments from the current literature, sponsored by the American Foundation for AIDS Research, published by Williams and Wilkins, 428 East Preston St., Baltimore, MD 21202, U.S.A.; tel. (301) 528-4000.
- *Current AIDS Literature*, an up-to-date bibliographic information service on all aspects of AIDS. The articles drawn are from 1400 international journals seen by the Bureau of Hygiene and Tropical Diseases. Prepared by the Bureau and Gower Academic Journals. See address for *AIDS: an International Bimonthly Journal*.
- *AIDS FEEDBACK*, a computerized visual representation of the status of the global AIDS pandemic, in the form of maps, charts, and graphs. It uses up-to-date numbers of AIDS cases reported to the World Health Organization from around the world. Single-page modules may be reproduced without permission. Produced several times a year by Dr R.P. Bernard, Director of Epidemiology in Human Reproduction, Field Epidemiology and Liaison Office, 22 Av. Riant-Parc, 1209 Geneva, Switzerland. ■

Compiled by Margo Hawley
IDRC Library

A research network for Africa

A group of AIDS researchers from East and Southern Africa has formed a network for sharing information and expertise. They also expect it will serve as a mechanism for conducting joint research projects.

The members of the founding group first aired the idea in Nairobi in March 1988, and met several times after that to work out the purposes and operation of the network. To date, researchers from Kenya, Mozambique, Uganda, Zambia, and Zimbabwe have participated in the planning meetings.

African scientists and other AIDS specialists often work in relative isolation, yet are focusing on the same problems as their colleagues in neighbouring countries.

For example, the link between HIV infection and tuberculosis, risk factors for heterosexual transmission, the nature of mother-to-child transmission, the problem of condom use by prostitutes, and the impact of AIDS on the family—these are all subjects that might be tackled by inter-African cooperation.

The founding group believes the network, which has received some preliminary funding from IDRC, might also serve as a body for evaluating the effectiveness of national AIDS control programs. At the same time, it could open up opportunities for researchers to be trained in neighbouring countries in areas such as HIV screening or the execution of targeted education campaigns.

Lastly, the network could enable researchers to assist each other in developing research projects, identifying funding sources, and reviewing each others results and scientific papers.

For the time being, a team of AIDS researchers at the University of Nairobi is serving as the network secretariat. It is also responsible for publishing a newsletter for members.

For more information, contact:
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African women against AIDS

A group of African women has formed a continental organization aimed at helping women to protect themselves from AIDS.

The Society for Women and AIDS in Africa (SWAA) is particularly interested in the plight of female prostitutes, because of the high risk involved in such work.

"It's not only a matter of giving out condoms to prostitutes to give to their clients," says the Society's president, Dr Fathia Mahmoud, a Sudanese medical doctor in obstetrics and gynecology who has also been conducting AIDS research in the U.S. "We are also concerned that the social and health problems of female prostitutes should be addressed in a more scientific way. We should find solutions, we should improve their socioeconomic status. And we want to get our social scientist colleagues to help us with research in this area."

The SWAA was formed in June 1988 at the international AIDS conference in Stockholm, Sweden. Recently, its officers have been busy looking for donors to provide core funding for the young organization.

African women in general face a number of situations in which there is a high risk of HIV infection, says Dr Mahmoud. "Women are more likely to receive blood transfusions than any other group, particularly during pregnancy and childbirth.

"The Society would also like to address certain traditional practices which put

women at risk of HIV infection. For example, female circumcision, scarification, early marriage, early childbirth, and nutritional taboos. We also know that cultural and religious practices which allow African men to marry more than one wife and to have multiple sexual partners increase the risk of HIV infection and other sexually transmitted diseases in women.

"We are trying to promote female education and address the problem of the inadequacy or absence of specific health care for women," says Dr Mahmoud. She would like to see more women in policymaking roles in these areas.

The focus of the Society's work will be to set up health education programs aimed mainly at rural women. But each will have to be tailored to local needs since "what's appropriate for Kenya won't be appropriate for Sudan," says Dr Mahmoud. To this end, the Society hopes to launch a program of social and behavioural research on women.

"We are definitely going to work with established AIDS programs such as the national committees on AIDS," says Dr Mahmoud.

Both men and women are welcome to join SWAA. A small membership fee is requested. For more information on SWAA, write to Dr Mahmoud at P.O. Box 1598, Khartoum, Sudan.

Gerry Toomey

Blaming Others

Blaming Others is a small, excellent book by Renée Sabatier, director of the AIDS unit at the Panos Institute in London. It shows how the AIDS pandemic has instigated many false accusations, usually founded on racial prejudice.

Even the scientists at the respected Centers for Disease Control in the United States classified Haitians as a high-risk group from 1982-1985. Today, experts reject the idea of high-risk groups and prefer to talk about high-risk behaviour.

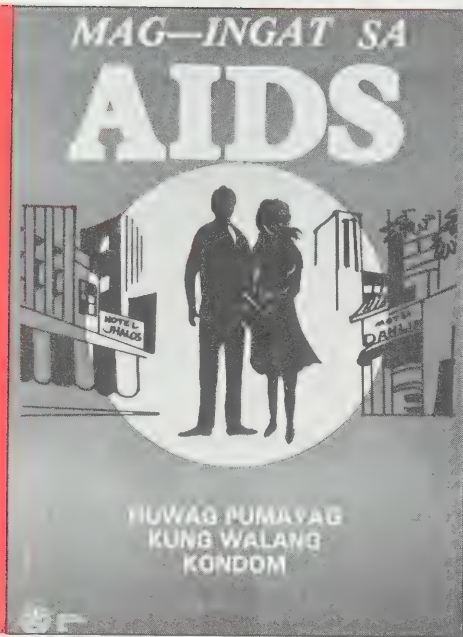
Blaming Others lists the accusations that AIDS has bred. In the United States, the Haitians were blamed for the spread of the AIDS virus; in India, the authorities wanted to test all African students; in the Soviet Union and Africa, the U.S. was accused of fabricating the AIDS virus; and, of course, journalists were accused of distorting the facts.

Finally, Ms Sabatier shows us how, in the industrialized countries, AIDS affects mainly the poorest and most marginalized populations. It has also reached high levels in a number of developing countries. What seems to be shared by all those who develop AIDS is poverty. After all, AIDS is a problem of development.

Blaming Others (167 pages) can be ordered from The Panos Institute, 8 Alfred Place, London WC1E 7EB, U.K. ■

Jean-Marc Fleury
Ottawa

VISUAL AIDS: A DIVERSITY



Philippines (Tagalog language): "Beware of AIDS. Don't have sexual intercourse with your partner without using a condom." Message aimed at prostitutes.



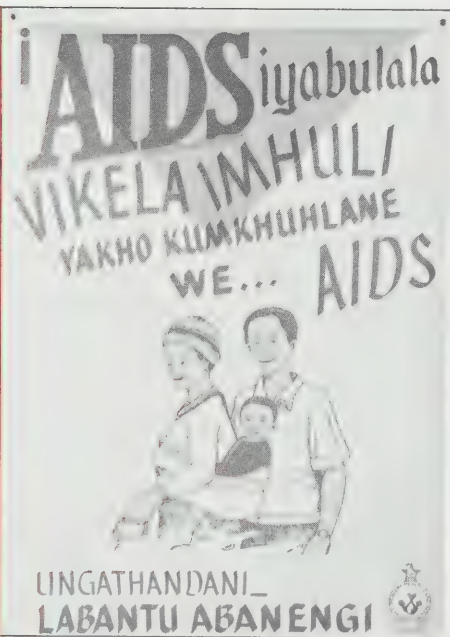
Jordan (Arabic and English): "AIDS".

Around the world, poignant messages about the threat of AIDS are being crafted and disseminated via print and electronic media, as well as by word of mouth. Wall posters are one of the more common means of expression used in AIDS prevention.

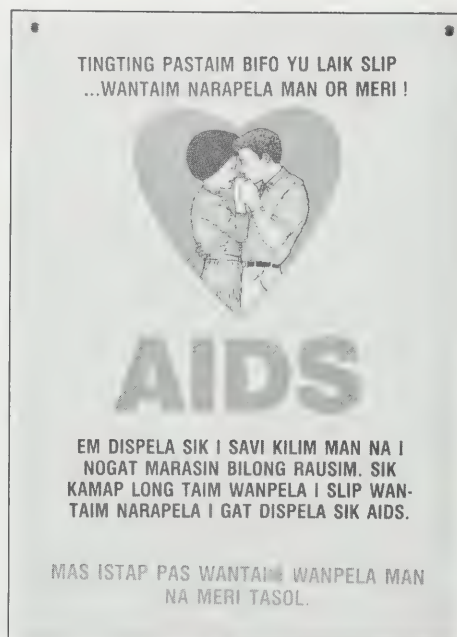
Posters are not neutral messages of basic fact, says Dr James Miller, the curator of an international traveling exhibition of posters entitled *Visual AIDS*. Rather, they are cultural expressions reflecting the "divergent political interests, social agendas, and sexual concerns of their producers."

The *Visual AIDS* collection, of which 10 posters are featured here, was organized by members of the AIDS Committee of London Canada and the Frontiers of the Humanities Seminar at the University of Western Ontario. Funding was provided by the London Life Insurance Company.

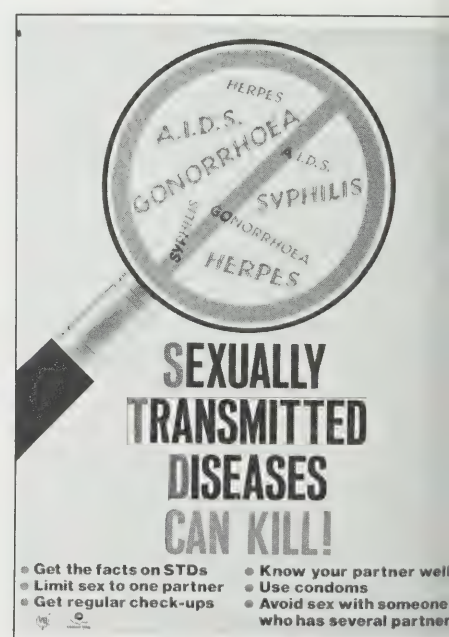
"AIDS posters are among the more transient representations of the epidemic," says



Zimbabwe (Ndebele): "AIDS kills! Protect your family against the disease of AIDS. Don't sleep around."



Papua New Guinea (Melanesian pidgin English): "Think before you have sex with another person... either man or woman! AIDS kills people and there is no cure... Stick to one partner only..."



Jamaica

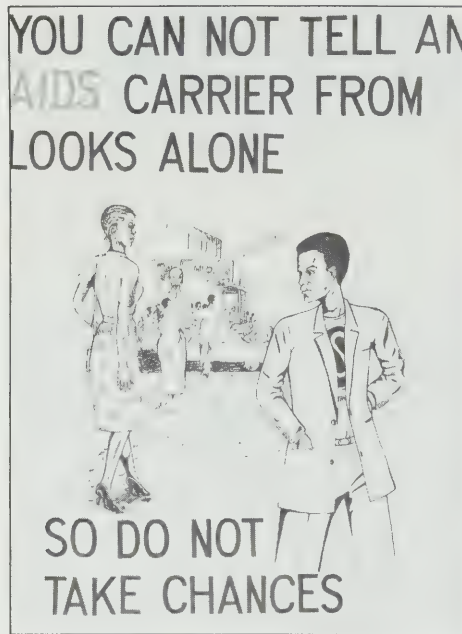
OF CULTURAL RESPONSES

Dr Miller. "As such, they are particularly valuable in showing that the disease is anything but an immutable set of biomedical or historical 'facts' existing apart from its social constructions. AIDS posters are not great art produced for eternity. They are pinned on bulletin boards or unfurled at bus stops or stapled to trees with the full expectation that they will soon be torn off, blown away or spray-painted over."

The posters in the *Visual AIDS* collection were produced and contributed by a variety of organizations: international health agencies, government offices, AIDS committees, gay action groups, health centres, charities, advertising firms, artists' cooperatives, universities, churches, and street people's coalitions. More than two dozen countries on five continents are represented.

Visual AIDS will be on display at Galerie John A. Schweitzer, 42 Avenue des Pins Ouest, during the V International Conference on AIDS in Montreal this June 4-9.

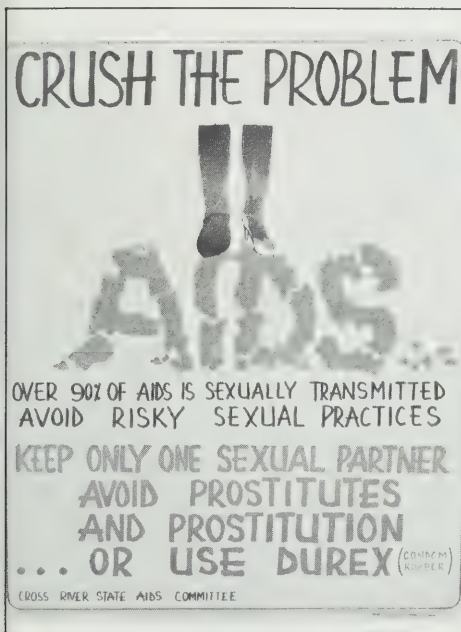
Studio photos: John Tamblyn Inc.



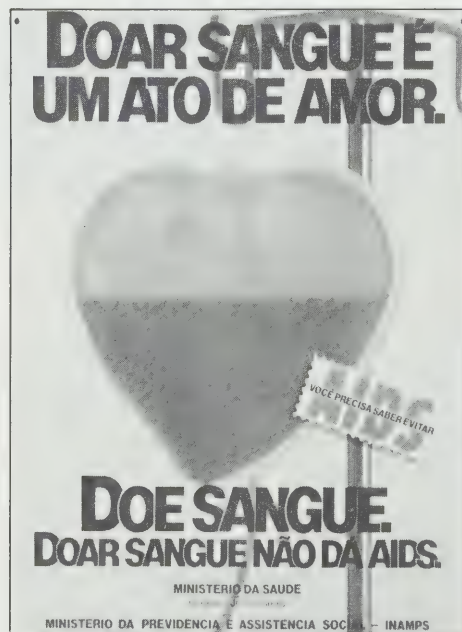
Zambia



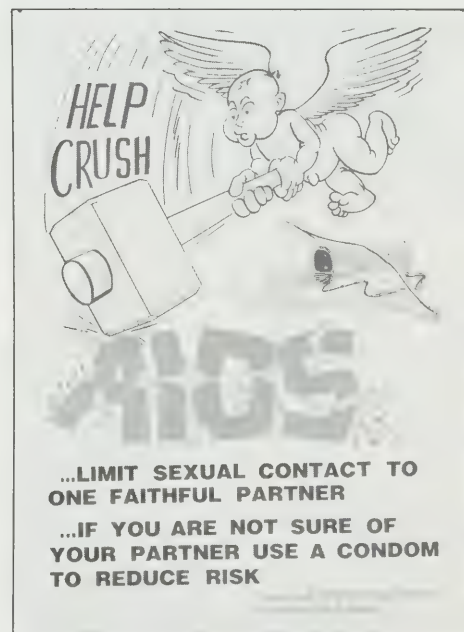
Kenya



Nigeria



Brazil (Portuguese): "To give blood is an act of love. Give blood. Giving blood does not give AIDS."



Trinidad & Tobago

MUSSEL RAFTS OF CHILOÉ



Photo: Oscar Chaparro

Mussel rafts—and profits—in the making. The use of locally available wood makes the raft design affordable for the residents of Chiloé.

OSCAR CHAPARRO

“The estuary doesn’t yield much any more,” says Sigifredo Lehuin, a mussel producer in Yaldad on the southern Chilean island of Chiloé. “There used to be natural beds of mussels everywhere, but now people who want to earn a living from the sea have to farm it.”

Mr Lehuin and four other families are working with a research team from the Austral University’s Institute of Marine Research to set up mussel culture facilities in the area.

“The only solution left for us is to build mussel-growing rafts,” says Mr Lehuin. The five families now have two rafts in place, which annually produce 20 to 24 tonnes of mussels for each family. Their results have encouraged other fishermen to follow their example—in 1987, 15 other local families joined the project.

The island of Chiloé has always been renowned for its seafood. Its clear waters

and numerous protected bays have traditionally been very productive. Some years ago, though, several processing plants were set up on the island but over-harvesting soon wiped out this natural resource.

In 1984, with IDRC’s assistance, the Institute of Marine Research started work on “choritos”, a local name for the mussel known scientifically as *Mytilus chilensis*. The team also studied giant mussels (*Choromytilus chorus*), known locally as “choro zapato”, as well as oysters.

At a small research station in Yaldad, biologists are discovering how these organisms grow and reproduce. In mussels, reproduction occurs in the water when “gametes” (mature germ cells) fuse, thereby producing larvae. The larvae then swim about for three or four weeks before attaching themselves permanently to an object.

Researchers examined the behaviour of this mollusc in great detail and attempted

to answer various questions. Where and when are larvae to be found? How long do they swim about? When and to what do they usually attach themselves? The researchers also looked into aspects of mussel marketing.

Using their results, Yaldad has become the largest producer of spats (mussel embryos) in the country. In fact, production increased from 30 tonnes in 1984-85 to over 1000 tonnes in 1988-89.

Rafts made from local materials

On Chiloé, suspension rafts seemed to be the best production method. Similar rafts are found in many mussel operations throughout the world, so the technique for building them was not new in itself. But the researchers improved the rafts by using local materials (including wood). This cut the costs so that artisanal fishermen and farmers in the region could afford them.

The local community gradually began to express a desire to participate in the



Photo: Oscar Chaparro



Photo: Sergio Sanchez

Right, workers display a string of young mussels known as spat. A rope hanging in the water below the raft serves as a point of attachment. Above left, mussel harvest on Chiloé Island. Above right, adult giant mussel locally known as "choro zapato".

Photo: Oscar Chaparro



project. Several artisanal fishermen who had been helping out the researchers were interested in their technological success and said they themselves were prepared to try mariculture.

The researchers waited until they had completed all their biological studies and had gathered all the necessary information before involving the local population. Even then, the technology was introduced slowly.

In 1986 five families were selected to participate in the experiment. "They were chosen for their sense of responsibility and serious attitude," says project director Jürgen Winter, of the Austral University in Valdivia, Chile. "This was important because the future of our efforts to disseminate the technology depended on these families. If we had failed with them, no one would have wanted to get into mussel culture."

The families visited the Yaldad station to learn mussel culture techniques. Station staff also showed them how to assemble

the all-important rafts. A year later, the families were able to harvest the fruit of their labour—splendid mussels that would be quickly snapped up on the market. The money earned was re-invested by the families in a second raft.

News of the success of these families spread quickly and there are now 19 small family enterprises producing mussels in the region. Heads of families were all trained at the Yaldad station as part of the project.

Seed for all

Besides helping families living near the Yaldad station, the project also stimulated the establishment of other mussel culture ventures by supplying local entrepreneurs with the spat needed to start their own operations.

Yaldad Bay is still a preferred site for gathering spat. Twenty-four mussel culture enterprises have set up their collectors in the bay. The harvest of spat is sent

to other sites where the mussels are raised to market size. The hope is that some of these sites will in turn become spat suppliers in the near future.

Visitors from various South American countries have visited the Chiloé installations and are considering how the technology might be applied in their regions.

Dr Winter himself is surprised at the results. "Initially, we thought convincing the local people would be the hardest part. But in the end it happened all by itself. Our experimental raft aroused the interest of the first families, who had no difficulty in convincing their neighbours."

The researchers are now working on other molluscs to diversify local production and prevent market saturation. ■

Biologist Oscar Chaparro works at the Institute of Marine Research of the Austral University of Chile. Some of the interviews for this article were conducted by Sergio Sanchez Bahamonde, a journalist in Santiago.

RIO'S SHAKY SHANTYTOWNS

CLAUDE ARCHAMBAULT

The torrential rains that fell on Rio de Janeiro in February 1988 led to the death of over 200 people and devastated several areas. Most of the victims lived in "favelas"—shantytowns perched on the steep flanks of fragile hills with unstable soil. Rebuilding their homes will be a long and costly process.

Favelas sprang up in the Brazilian city in the mid-1930s as shelter for newly arrived migrants who wanted to live close to their jobs. Fleeing regions hard hit by drought or unemployment, rural Brazilians thronged to the "marvelous city" of Rio, lured by its illusory riches.

By 1970, at the time of Rio's real estate boom, tens of thousands of Brazilians were leaving the countryside to seek steady jobs

in the city. Today, over 1500 people cherishing the same hope arrive in Rio daily. These "favelados" often must live in unhygienic conditions, with virtually no sewage and refuse collection.

Crowded between rocky peaks and the sea, Rio is a densely populated city in economic decline. It doesn't have the public services essential to a major urban centre. Good sites for housing are becoming impossible to find—all that remain are the mountains and areas expropriated for the highways slashing through the city. This land is inappropriate for residential construction.

Two million men, women and children—a quarter of the city's population—huddle together in Rio's shantytowns. And they are not alone. Slum congestion is a fact of life in all of Brazil's large urban centres: Sao Paulo, Brasilia, Belo Horizonte, Porto Alegre, and Manaus. In Sao Paulo, a megalopolis of 12 million people, shantytowns occupy almost all of the urban periphery.

The most crowded favela, Morro da Formiga (Ant Hill), is located north of Rio, 250 metres up on the Tijuca Massif. Here and in two other districts, the Civil Engineering Department of the Pontificia Universidade Católica do Rio de Janeiro, with technical support from the University of Alberta, is doing research to try and improve the safety of the favelados' homes. The work is funded by IDRC.

At the moment, studies of the geological and sedimentary soil characteristics in the favelas are random and incomplete. But the devastating effects of the heavy rainfall on the fragile slopes of these hills are well known: mud slides, rock slides, and floods.

The technical data that would make it possible to prevent these catastrophes is clearly insufficient at present. During the recent flooding, four persons were killed and 27 houses destroyed by rock falls from the peak of the mountain where the Formiga favela perches. More research is needed on the nature of these unstable sites.

During a recent visit to the favela by a small group, a fine rain was sweeping over the hill. Thick fog swathed the summits of neighbouring mountains. We passed a group of children accompanied by a rickety dog. At first sight, the Ant Hill favela looks no different from a regular village. However, as one ascends and the dwellings increase in number, the wretched condition of the foundations of many houses can be seen.

Three or four streams running down the



Unstable hillside soil and improper drainage make Brazil's shantytowns a dangerous place to live, especially when torrential rains hit.

Added to the problem of unstable favela slopes is the poor quality of housing construction.



slope are littered with refuse. Electrical wires are strung low and appear to be in bad condition.

"Ideally, these people should not be living here, because it is so dangerous," says Professor Vargas of the Universidade Católica. "But it is not as simple as that. We intend to identify the major high-risk areas in the municipality. Using precise measuring instruments, we are attempting to provide the prefecture's geotechnical team with maps, charts, and statistics on why the hills are unstable.

"You can sum it up this way: deforestation, refuse accumulation, and soil erosion are the major causes. Cuts into the earth for housing construction are another determining factor. So we are preparing a summary of the geology of this area, in order to propose solutions."

Rio's favelas are built on two types of soil. The first, termed residual, is the product of rocks being washed year after year. The second, termed alluvial, has been transported by rainwater or gravity. Both of these soil varieties are present in Ant Hill—hence its scientific interest.

The researchers are analyzing soils and studying contours with the help of satellite photography. In this way, they will be able to put together maps to indicate to the

authorities where the dangerous areas are. Sites will then be classified for the purpose of locating probable soil movements, and the type of vegetation and tree growth in these favelas will be analyzed.

Finally, the researchers will attempt to reconstruct the history of these favelas, each of which is unique in terms of evolution and land use.

In several places, on the surface of the slopes, the sedimentary layer is very thin and saturated with water. When heavy rain falls, the earth remains impermeable. Rain water is transformed into devastating torrents that run down the slopes. The torrents cause considerable damage and frequently spew out tonnes of refuse accumulated over the years.

"The authorities intervene in two ways to deal with these dangers," says Herbem Maia of the municipal geotechnical department. "First, we install drainage channels that divert the water to safe locations. Then, and this is the biggest problem, we use reinforced concrete in an attempt to stabilize the enormous rocks that threaten to topple from the summit. Unfortunately, this is not a permanent solution. As far as possible, we also encourage people to move, but this is unrealistic, given their number and lack of funds. And it is difficult

to demand that families who have been living here for two generations leave everything overnight!

"Attitudes have changed a great deal," he adds. "A few years ago, people were ashamed of living in a favela. The word favela has become pejorative and insulting. People prefer to use the word 'community', which is more accurate. Some of them are well organized and carry a lot of political weight with the authorities."

The research team is attempting to establish a model that could be used first in Rio, then on a national scale, and eventually in any city with similar environmental conditions. Rio will have a map of high risk areas that can be used for disaster prevention.

Meanwhile, plans for the construction of low-rent housing, into which the most underprivileged favelados would be relocated, are on shaky ground, financially speaking. In fact, the project may never see the light of day. Last fall, Mayor Saturnio Braga announced that Rio was bankrupt and could not pay its 104 000 public servants. ■

Claude Archambault is a freelance journalist based in Montreal. He visited Brazil in September 1988.



Photo: Denis Marchand

This Malian man's chew stick, from a lemon tree, gives him "such a sensation of freshness and cleanliness that I never use a toothbrush!"

WHAT LOVELY TEETH!

THE BENEFITS OF CHEW STICKS

DENIS MARCHAND

About 70 percent of Kenya's primary school students don't brush their teeth every night before they go to sleep. Yet most of them have less dental plaque than toothbrush users, a recent study by Kenyan researchers shows.

Kenyan children living in rural areas use a chewing stick called a "mswaki" to clean their teeth and gums. This simple piece of wood is proving to be an effective weapon in fighting dental cavities.

Mswaki use is not peculiar to Kenya. For centuries, people in Asia, Africa, and the

Middle East have used twigs or tree roots to pick their teeth and maintain good oral hygiene. They also chew on the sticks.

This aroused the interest of Nigerian researchers. In 1983 they discovered that some species of twigs and tree roots contain certain chemical compounds (fluors and polyphenol tannins) that slow down the production of lactic acids and dextrans, the primary agents of dental plaque formation.

The Mazingira Institute and the Kenyan Medical Research Institute (KEMRI) conducted a survey of traditional oral hygiene practices. Funded by IDRC, they found that

at least 289 different species of tree or shrub are used for mswakis and that in general mswaki users have very healthy teeth.

Since few comparative studies have been done, KEMRI has decided to conduct chemical and biological analyses of the 10 species of tree most used in Kenya. "This will give us an idea of their specific organic composition and actual therapeutic effects," says Davinder Lamba, research coordinator at the Mazingira Institute.

Other research has proved that chew sticks not only protect teeth against cavities but also strengthen the roots of teeth and the gums. Food particles lodged between the teeth are removed and the teeth are polished at the same time. Above all, the chewing increases blood circulation in the gums and produces a beneficial movement of the roots.

Several toothpastes now contain fibres and resins extracted from trees growing in various parts of the Third World. *Salvadora persica*, commonly called "Pee-lu" in Asia and used there as a chew stick, can now be found in American toothpaste.

The Mazingira Institute is planning a prevention campaign to inform young people about the therapeutic value of mswakis. The best way of using them will be explained, and advice will be given on the benefits of a sound diet and good oral hygiene, as a means of preventing acids from attacking teeth.

Without wishing to downplay the effectiveness of mswakis, Dr Lamba points out that the absence of cavities in rural areas is also related to diet. Rural children, he says, eat whole grains and green vegetables, and consume less sugar and pastry and fewer soft drinks than their urban cousins.

Denis Marchand is a freelance writer and photographer based in Montreal, Canada.

CLEANING WATER WITH SUNSHINE

Beirut has been heavily damaged by bombs over the years. People often fall ill from contaminated water because purification plants don't function.

ROBERT BOURGOING

It's raining in Beirut. Despite the miserable weather, the old man keeps his appointment on Museum Street. For the first time in years, he is paying a visit to East Beirut, even though he lives only a few metres away, on the other side of the Green Line—the imaginary border that has divided the city since the beginning of the war.

It is dangerous to cross over to the east, but he insists on meeting with us to report on the results of his research, partly funded by IDRC.

The man is Aftim Acra, a researcher and professor in the department of environmental sciences at the American University in Beirut. His work could have a significant impact on the health of more than a billion inhabitants of this planet—people affected by waterborne diseases such as cholera, typhoid, viral hepatitis, salmonellosis, and dysentery.

Together with his assistant, Yester Karaghopian, and a team of Lebanese university researchers, Dr Acra has developed a simple and inexpensive system for disinfecting water. It uses the most abundant natural resource in developing countries: sunshine.

His research, which began in June 1979, demonstrated that solar radiation, especially ultraviolet rays, can destroy microorganisms in water very efficiently. When exposed to the sun, water in small plastic or glass receptacles becomes free of pathogenic bacteria in a few hours, and is then safe for human consumption.

"It's so simple and obvious that many people refuse to believe us, until they do the experiment themselves!" says Dr Acra.

Tests to date indicate that the effectiveness of the technique depends on several factors. The water must be irradiated in transparent containers of small volume—one to three litres. These must be exposed directly to the sun, when it is at its brightest, for periods varying from 95 to 300 minutes. The best results are obtained using clear water with few suspended particles and low bacterial density.

Dr Acra admits that his solar disinfection procedure has certain limitations. First, it

isn't an efficient way to treat waste water. Secondly, the rainy season presents a major obstacle to its use in tropical countries. And thirdly, some bacteria can develop a resistance to the destructive effects of the ultraviolet rays.

Simpler, cheaper than chemicals

However, Dr Acra believes the method has enormous advantages over current techniques. Chlorine and iodine, for example, are expensive and difficult to handle, must be imported, and give water a disagreeable taste. Boiling water is often an almost impossible task in regions where wood is scarce, and where much time and labour are needed to gather it. Compared with these methods, solar energy is free, plentiful, renewable, and can do the job without human intervention.

It is not surprising that research in this area has been carried out in Lebanon. Since the beginning of the war, many people have been regularly admitted to hospitals with illnesses stemming from contaminated water.

Treatment plants bombed

The country's 120 water treatment plants have been seriously damaged or destroyed by bombs. The employees have abandoned them, and the equipment has been stolen or destroyed by rust.

In Beirut, where water is rationed, a single treatment plant serves over one million inhabitants. It is not maintained, the measuring equipment is out of order, and the water which comes from it smells strongly of chlorine.

Last August, at the invitation of IDRC and McGill University's Brace Institute, a dozen researchers from Algeria, Colombia, Egypt, India, Peru, and Thailand met at

Ste-Anne-de-Bellevue in Quebec to compare the results of their research, inspired to a large extent by the work of Dr Acra.

His water purification technique has already been tested successfully in Poona, India, to prevent the transmission of cholera in particular. The International Red Cross has obtained the same positive results in tests carried out in the Arab Republic of Yemen.

Dr Salah Arafa, principal researcher in charge of a solar disinfection project in Egypt, has worked in close cooperation with Aftim Acra. Water drawn straight from the wells (most of which are contaminated) of a small village in northeast Cairo was tested in a lab. A period of three hours was sufficient to eliminate most of the bacteria that it contained.

Like Dr Acra, Dr Arafa is working to develop a permanent system for continuous water treatment. Such a system must be easy to install and must use simple and affordable materials.

Some 75 percent of rural people in developing countries have no access to sources of clean drinking water. In these countries, 80 percent of all illnesses are waterborne, according to the World Health Organization. It is easy to see the enormous impact that the tests in Lebanon might have on the struggle to eliminate major diseases. Revolutionary or not, the prospect of using solar energy to purify water is of fundamental importance in developing countries. ■

Robert Bourgoing is a journalist based in Edmonton, Canada. He wrote this article during a Middle East study trip sponsored by the Fédération professionnelle des journalistes du Québec.



Photo: Robert Bourgoing

QUINOA'S COMEBACK

The ancient staple of the Incas, a nutritious grain called quinoa, is finding its way back into the diet of many people in the Andean highlands of South America. Better varieties are now available, but getting them to farmers is still a problem.



Photo: Jaime Rojas

ROBERT INNESS

A single, recurring image dominates the landscape of the high Andes of South America: thousands of small agricultural plots, bordered by stones, on steep hills.

Hillside farming is one way to protect crops, even if only for a few days, from the killer frosts that arrive first on the exposed plains. A consistent feature in this patchwork of plots is the traditional food grain, quinoa (*Chenopodium quinoa*).

Annual rainfall in this long strip of South America is low—300 to 600 millimetres. By using time-proven crop combinations, usually including quinoa, farmers minimize losses caused not only by frost but also by lack of moisture.

The peasant farmers of the high Andes—an area stretching from Colombia

and Ecuador, through Peru and Bolivia, to Chile and Argentina—have grown quinoa for centuries. In fact, it was a staple in the diet of the people of the Inca Empire. Today, quinoa is cultivated and harvested much like other cereal crops, but its very special properties are not forgotten by the descendants of the Incas.

Victor Mamani lives in the village of Jiscuani, near Lake Titicaca, some 3 800 metres above sea level. Like most farmers in the area, he grows enough quinoa to feed his family.

Recipe for longevity

"My children need quinoa because it contains calcium and will prevent cavities," he says. He knows it is also good for adults and points to the previous owner of his farm, who is 96 years old, as living

proof. According to Mr Mamani, a diet of quinoa, barley, and cheese should be given credit for the man's longevity.

Quinoa is rich in protein—16 percent compared with 10 to 12 percent for other cereals. What is noteworthy about this protein, however, is not the quantity but the quality. It contains a balance of amino acids unmatched by wheat, maize, barley, or potatoes. In fact, 37 percent of quinoa's total protein is composed of essential amino acids in proportions similar to those found in milk. The grain contains more of the amino acids methionine, cystine, and lysine than most vegetable plant sources. These essential acids enable it to act as an effective food substitute for meat and oilseeds.

For this reason, quinoa is a major ingredient in the diets of some 10 million inhabitants of the high Andes. It can be boiled and eaten like rice, added to soups, popped like popcorn and brewed into a beer known as chicha blanca. Its green leaves can be used in salads or for animal feed, and the stalks are burned in cookstoves, composted, or consumed by grazing animals.

Despite its nutritional value and versatility as a food, quinoa was for a long time considered a plant of limited agronomic and commercial potential, even within its own natural growing region. Although it has the biological potential to yield up to 4000 kilograms per hectare, in practice cold weather and low rainfall combine to severely limit yields. Among the 120 000 farm families who grow the crop in Bolivia, for example, yields have sometimes been 400 kilograms or less per hectare.

Furthermore, research methods were not geared to a crop grown in association with maize, barley, and faba beans, on tiny isolated farms of only one or two hectares. Only at high elevations is quinoa grown as a single crop, usually after potatoes.

Another drawback is the presence of a bitter compound called saponin in the hard

Bolivian farmer Victor Mamani believes quinoa in the diet promotes longevity.



Photo: Robert Inness

seed coat of quinoa. To remove the compound, quinoa is washed in running water and then dried for a few hours or cooked immediately. Alternatively, the grain can be dehulled mechanically or by hand, but this doesn't remove all the saponin.

Finally, because quinoa has a low gluten content, a crucial substance in the production of wheat products, it cannot be used to manufacture bread, pasta, and biscuits. Yet in Bolivia, in the early 1980s, the government, faced with rising prices for imported wheat, rice and maize, attempted to introduce quinoa flour. It introduced a law requiring five percent substitution of quinoa flour for wheat flour in the processing of foods. But insufficient production and inadequate processing facilities have made the law impractical.

Production on the rise

Over the past decade, though, quinoa production has experienced a resurgence thanks in large measure to the Instituto Boliviano de Tecnología Agropecuaria (IBTA). With the support of IDRC funding, IBTA has created, since 1979, a regional research base for genetic selection and refinement of cropping practices.

Together with quinoa researchers in Peru, Ecuador, and Colombia, IBTA has established the Andean Crops Network, whose members meet yearly to exchange scientific information and the latest research results.

The key quinoa researcher in Bolivia is Humberto Gandarillas. Coaxed out of retirement to head IDRC's quinoa project, he was a logical choice because of his quinoa seed research in the 1960s which helped to broaden the genetic pool and spawn an ambitious breeding program.

Under the first phase of the IDRC-supported work, Mr Gandarillas and his fellow researchers succeeded in breeding improved varieties of quinoa. Under controlled conditions, some new lines are yielding as much as 5000 kilograms per hectare.

In Bolivia, the area planted to quinoa has

increased at an average annual rate of 34 percent since 1979. IBTA estimates that 40 percent of this total area is now sown with improved quinoa varieties, primarily Sajama, developed by Mr Gandarillas in the 1960s. Facilities such as the Patacamaya research station are distributing enough of the modern varieties, especially one called Chukapaka, throughout Bolivia to seed 3000 hectares per year.

There have been some disappointments though. On-farm trials revealed that some new varieties, including Chukapaka, were not well adapted to certain regions. Although Chukapaka promised high yields and a good tolerance to frost, it turned out to be a "late" type—that is, subject to early frosts and therefore not suited to some areas.

Some new varieties also proved to be susceptible to mildew, and poor response to fertilizers was also observed because of poor environmental conditions. Nitrogen boosted yields only in those regions with irrigation or adequate rainfall, and neither potassium nor phosphate application was seen to benefit the plants.

Improving the yield of the quinoa crop itself, however, has not been the prime goal. The researchers are more interested in increasing quinoa's dependability and contribution to the overall farming system. That is, they hope to ensure that the farmer's limited resources are used to the best advantage and production risks are minimized.

A third phase of quinoa research by IBTA was approved by the IDRC's Board of Governors in 1985. The aims are to continue improving quinoa, distribute the superior varieties, and to study and improve farming practices. The researchers will also transfer their results to technical staff and farmers.

Socioeconomic and agronomic surveys are helping the researchers to uncover variations in quinoa farming. Topography differs from valley to valley and nuances in cropping systems have evolved within small areas. These differences affect a

farming community's potential for successfully adopting new varieties.

Extension difficulties

Passing on research results via the extension system to those most in need has been a problem in Bolivia, as in many countries. Resources in Bolivia are barely adequate to keep researchers motivated and only a small proportion of the national budget is committed to agricultural extension. Working with subsistence farmers under the harsh conditions of high altitude areas is poorly paid and not very well rewarded by promotions within agricultural institutions.

However, the assistance of foreign donors has enabled researchers to promote extension in novel ways. Under the IDRC-supported quinoa project, for example, one- or two-day courses are offered to farmers four or five times a year. Each attracts from 25 to 40 participants. Topics include nutritional value, grain characteristics, pest and disease tolerance, growth habits, and optimum cropping practices.

The project has also produced a video that has proven to be more effective than Spanish publications for communicating information to local farmers who speak mainly Quechua and Aymara.

IDRC recently established pilot plants in the Andes to make quinoa processing more efficient. And, in addition to the Bolivian research program, it has sponsored a three-phase program in Ecuador and funded quinoa research in Colombia.

It will still be a few years before it is clear whether quinoa can be restored to the prominent position it enjoyed several hundred years ago. In the meantime, the Andean nations, with their economic difficulties and limited resources, will need continued support from donors for research to improve highland crops and farming systems. ■

Robert Inness is an agricultural economist and consultant based in Ottawa.

HONEY FROM THE TREETOPS

FOREST RESOURCE OF MALAYSIA

Photos: Janet Durno



The honey gatherer's ladder. The tualang tree's smooth bark deters all ground-based predators, except human beings.

JANET DURNO

The smooth trunk of the massive *Koompassia excelsa* tree, which rises 35 metres straight up before breaking into a crown of delicate leaves, glimmers in the starlight. To Malaysians, the tree is known simply as "tualang", which is also the local name for wild bees.

The tree is aptly named. Bees are attracted to it for nesting because its great height gives them access to the tropical sunlight and because its smooth bark deters predators from climbing.

Tonight, however, two dim human shapes can be discerned inching their way up the tree, constructing a ladder as they go. A beeswax candle, lit during the ritual that preceded the climb, burns far below the men, at the foot of the tree. Here, other members of the team wait with ladder pieces, torches, and a cowhide honey basket that will be hauled up into the tree as needed. From the 20 bee colonies, hanging like half moons beneath the branches, there comes no sound. When it is dark, the bees are not aggressive. Now is the time to collect the honey.

'Black sweet and falling stars'

Finally, the climbers perch on a branch above the first colony and call for a smoldering torch to be sent up to them. The torch is brushed quickly over the colony to disturb the bees, then rapped sharply against the wood. As a cascade of brilliant orange embers drifts slowly down, the haunting song of the honey gatherers rings out across the forest. They call on the 'black sweet' to follow the 'falling stars' to the forest floor. One of the many taboos that surrounds honey gathering is the pro-

hibition on the use of words like 'bee', 'sting', or 'fall'.

The bees pursue the falling embers in an angry humming stream. When the embers burn out, the bees settle on the ground or on neighbouring trees, unable to find their way back into the tualang tree until the first light of dawn. The comb, now virtually unprotected, is sliced from the branch by the honey gatherer who discards the brood comb and places the honeycomb in the basket. Honey patters like rain onto the leaves below.

In this one night, 12 colonies are harvested. The combs are small, only about half a metre long. (Colonies of *Apis dorsata* bees sometimes construct combs two or more metres in length.) Three tins of honey—about 60 litres—are obtained. The honey is rich, slightly bitter, and highly prized because it is believed to have medicinal and aphrodisiac qualities. It will sell for 20 ringgit (CA\$10) a litre. From this night's harvest alone, the honey gatherers will make about 1200 ringgit, a welcome addition to the small annual income of a Malaysian farmer.

This honey gathering expedition followed a two-day, IDRC-sponsored workshop in February 1988 at the Universiti Pertanian Malaysia (UPM). Organized by Professor Makhdzir Mardan, who is currently finishing his Ph.D. on *Apis dorsata* bees at the University of Guelph in Canada, the workshop brought 50 Peninsular Malaysian honey gatherers together with five researchers to talk about the biology of *Apis dorsata*, the rituals and techniques of honey gathering, and socioeconomic factors.

Despite the economic importance of



Left, this tree contains about 20 *Apis dorsata* bee hives among its branches. The honey gatherers work at night when the bees are less aggressive. Above, part of a *dorsata* comb.

Apis dorsata to the local farmers, little research has been done on this bee species. It is not easy to study insects that live in such a lofty abode, that forage among the flowers of the rainforest, and that can easily sting a researcher to death if disturbed.

The socioeconomic importance of the *dorsata* bee honey, like that of almost all forest products other than timber, is not well known. Statistics are difficult to obtain on products collected and sold locally for profits that generally remain within the community.

Tricks of the trade

The honey gatherers have an intimate knowledge of *Apis dorsata*. Most of them have studied for years under a 'pawang', or bee shaman, and inherited his bee trees upon his death. At the workshop, they enthusiastically explained the tricks of their trade: how to follow a bee through the forest to locate its tree; how to tell when a colony is storing honey by the subtle changes in the comb shape and in the colour of the bees; and how eagles, moths, and birds steal honey.

The honey gatherers also recited prayers and songs which were recorded. These will later be linguistically analyzed to unravel their roots in Javanese mysticism, Hinduism, animism, and Islam. They remained silent only about the secret rituals that cannot be divulged to outsiders.

Most of the honey gatherers are farmers who have never before ventured this far from home. The knowledge they shared with the UPM researchers—knowledge garnered over centuries of observation and experience—will be supplemented by the researchers with scientific description and verification. The researchers will continue to work with the honey gatherers on their home ground.

Just before the workshop began, the honey gatherers met with *Apis cerana* beekeepers and the UPM Malaysian

Beekeeping Research and Development team (funded since 1983 by IDRC to work on *Apis cerana*). Together they formed the Malaysian Beekeeping Association. For the honey gatherers this organization will provide a forum to lobby for the conservation not only of bee trees but also of Malaysia's remaining forested areas which provide homes, jobs, resources, and income for many farmers and villagers.

In Kedah State alone, there are more than 1000 known honey-gathering groups. With the average gatherer making 500 ringgit (CA\$250) a year from sales, it is clear that honey gathering has an important though largely undocumented impact on the local economy. For groups with access to a good bee tree—one that supports up to 150 colonies per year and yields honey worth 10 000 ringgit per year—honey gathering is a lucrative occupation.

Major problems for the honey gatherers are honey adulteration and smuggling. Much of the *dorsata* honey on the market is either diluted with water and sugar or comes from Thailand. Those selling adulterated or smuggled honey can undercut the price of genuine *dorsata* honey and edge the honey gatherers out of the market. Buyers, who prefer to purchase pure honey even if it is more expensive, can seldom detect the adulteration.

Even honey gatherers not affected by such competition can find marketing difficult if they are located in isolated areas. Because *dorsata* honey has a high moisture content and ferments rapidly, it must be consumed within a few weeks of harvesting. The Beekeeping Association may be able to help the gatherers with their conservation and marketing efforts.

The work of Prof. Makhdzir and the UPM researchers will help to identify and promote honey collection procedures that ensure sustainable yields. Gatherers who harvest colonies two or three times per season cut off only the honeycomb, leav-

ing the brood comb intact. But those concerned with making profits today take the easy route and cut off the entire comb from the branch.

Some honey gatherers claim they don't have the time to harvest all the colonies they know of. Others, on Langkawi Island, claim the number of bee colonies is decreasing every year. And where do the bees go in the rainy season? Over the sea to Thailand and Sumatra, say the gatherers.

As bees may travel up to 150 kilometres in search of seasonal nesting sites, it would be advantageous to set up a regional network or association to study the migration patterns of *Apis dorsata* and of honey gathering across national boundaries to make sure that the bees are not exploited into extinction.

On the morning after the honey gathering, the two men who spent most of the night in the tree are sound asleep in their camp. While other members of the group sit pouring honey carefully into bottles, clouds of bees hover about the ragged remnants of their combs high in the tualang tree.

Some of the gatherers believe a spiritual contract exists between bees and people: the bees will give up their honey but it is a human responsibility not to take too much, to leave enough for the colony to survive. But perhaps this contract with humanity should extend beyond the bees to the surrounding ecosystem. The forest itself—so important to both the honey gatherers and the bees—is full of gibbons and hornbills, elephants and bee trees. It could, however, disappear beneath the reservoir of a new dam. ■

Janet Durno, formerly a special program assistant for CUSO, based in Sarawak, Malaysia, is now a CUSO field staff officer in Bangkok, Thailand.

No incentive to halt overgrazing of 'free' land

The overgrazing of Lesotho's communal rangelands by cattle, sheep, and goats is not due to tribal customs related to wealth and prestige, but to simple economic forces. So concludes a recent study by researchers at the National University of Lesotho and Canada's University of Saskatchewan.

Lesotho, a tiny country of 1.7 million people and completely surrounded by South Africa, imports almost 50 percent of its food. Most of these imports come from South Africa, a country on which Lesotho would prefer to reduce its dependence.

Overstocking of herds leads to overgrazing of the rangelands, which inevitably degrades the land.

The IDRC-sponsored project with the Institute for Southern African Studies at the National University of Lesotho and the department of agricultural economics at the University of Saskatchewan looked at various aspects of Lesotho's agricultural markets. Through in-depth interviews, the research team determined that farmers' approach to livestock production was driven by classic market forces rather than tribal customs.

One of the researchers, Professor Gary Storey, explains that the overstocking of herds is the result of the country's land holding distribution systems. While farms are owned by families, grazing pastures are held in common, with no management structure. Because the communal rangelands are perceived as a "free" resource, there is no incentive for farmers to limit their herds.

The report recommended policy changes, including public education and a new system of taxes on herds. The government of is now adopting some of the report's recommendations.

André Potworowski
Ottawa

Forced to flee

Environmental refugees are the largest class of refugees in the world today. But most governments don't recognize environmental decline as a legitimate cause for refugee movements, says the Worldwatch Institute.

In the recent Worldwatch Paper *Environmental Refugees: A Yardstick of Habitability*, Jodi L. Jacobson writes that "throughout the world, vast areas are becoming unfit for human habitation." She estimates there are 10 million environmental refugees in the world today.

Land degradation is the single most important reason for the existence of environmental refugees. A survey by the United Nations Environment Program (UNEP) estimated 35 percent of the earth's land surface is in various stages of desertification. These areas are home to more than 850 million people.

Although agriculture is the backbone of many developing economies, population and financial pressures have forced many farmers in the Third World to use short-cut methods that lead to long-term land degradation. Eroded, unproductive soils have spawned mass migrations in Africa.

Natural disasters such as floods, avalanches, and earthquakes are also responsible for a large number of refugees. But there is an increasing number of "unnatural disasters"—caused by human-induced changes in the environment such as deforestation and soil erosion. These can turn normal events such as flooding into catastrophes, as recently happened in Bangladesh.

More and more companies in the industrialized countries are paying to dump chemical waste in developing countries. But it is the citizens of those developing countries who pay the highest price. Many are forced to leave their homes, which have been contaminated, and others face the danger of toxic poisoning and chemical illnesses.

Some researchers predict a massive increase in the number of environmental refugees. The expected rise of worldwide sea levels caused

by global warming threatens the homes of millions, who will have to move farther inland and compete with others for scarce food, water, and land.

For a copy of this Worldwatch Paper, write to:
Worldwatch Institute
1776 Massachusetts Avenue, N.W.,
Washington, D.C. 20036 USA

Boris Gomez
Ottawa

The price of debt: child welfare

After 40 years of progress, large areas of the developing world are slipping back into poverty because of foreign debt, and it is children who are bearing the heaviest consequences. This is the main message of *The State of the World's Children 1989*, an annual report by the United Nations Children's Fund (UNICEF).

It is true that during the 1980s major gains were made in child health. The percentage of the world's children who were immunized against the major childhood diseases, for example, rose from 5 percent to 50 percent. Another advance was the widespread dissemination in the Third World of a simple and inexpensive technology called Oral Rehydration Therapy (ORT), a technique for treating the ill effects of diarrhea, a major killer of children. ORT now saves nearly a million lives a year.

But this progress has been countered by the economic decline caused by the debt crisis, according to UNICEF. "What we are seeing," says UNICEF Executive Director James Grant, "forces us to discuss the debt crisis less than politely."

The UNICEF report says that what developing countries need is "a combination of debt reduction and increased aid to unlock the doors to growth. Without growth, we will merely be rearranging the furniture inside the debtor's prison."

The UN agency calls for a renewed development effort—but one whose priority should be to meet "essential needs of all human beings for adequate nutrition, clean water, safe sanitation, primary health care, adequate housing, and basic education." Such development, it is estimated, would cost an extra \$30 to \$50 billion a year throughout the 1990s.

The report says the time may now be right for a meeting of the world's leaders to discuss the link between child welfare and socioeconomic development.

...and the total is \$1.3 trillion

Total Third World debt reached US\$1.32 trillion in 1988, up 3 percent from 1987, according to the World Bank. Last year developing countries paid US\$43 billion more in debt payments than they received in new loans.

"The time has come for the international debt strategy to enter a new phase," says Jean Baneth of the World Bank's economic division. Income per person in most debtor countries is still below the level it was 10 years ago. World Bank officials say the full effects of declines in health and education standards haven't yet been reflected in statistics.

In its annual report, the World Bank called voluntary debt reduction by bank creditors, including techniques such as debt-equity swaps and debt buy-backs, "an important breakthrough".

For a copy of the World Debt Tables, write to:
Publications Department, World Bank
1818 H Street, Washington, D.C.
20433
U.S.A.

WHO on food irradiation

"Food irradiation can, under certain circumstances, be safely used to help control two of the most serious problems connected with food supplies: the huge avoidable losses of food through deterioration and the illness and death that result from the consumption of contaminated food."

That's the position put forward by the World Health Organization (WHO) at the International Conference on the Acceptance, Control of and Trade in Irradiated Food, held last December in Geneva, Switzerland.

WHO says food irradiation can destroy certain pathogens that cause foodborne disease—one of the most widespread threats to human health. Food irradiation can also kill insect pests and destroy the microorganisms that hasten the spoilage of food. "In countries with a warm climate, the estimated storage loss of cereal grains and legumes is at least 10 percent. With nongrain staples, vegetables, and fruits, the losses due to microbial contamination and spoilage are believed to be as high as 50 percent."

While supporting food irradiation as safe, WHO says consumers have the right to know how the foods they eat have been processed and treated.

The difficulty now is for governments to pass legislation and draw up regulations to ensure that the setting up and operation of food irradiation facilities are safe.

For a copy of WHO's publication *Food Irradiation: A Technique for Preserving and Improving the Safety of Food*, write to:

World Health Organization
Distribution and Publications
1211 Geneva 27, Switzerland

Third World science journals cited less often

Out of 829 scientific journals having an important impact in their fields, none is from Asia (except for Japan) or Africa.

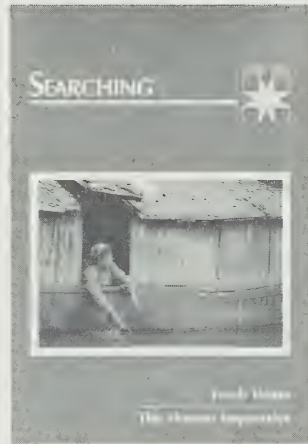
In a recent study, Subbiah Arunachalam and K. Manorama from the Council of Scientific and Industrial Research (CSIR), in New Delhi, India, found that almost 60 percent of high impact journals were published in the United States. A journal's impact is judged by how often its articles (including review articles, full-length original research papers, and short communications) get quoted in a given time span.

Arunachalam and Manorama found that a Mexican astronomy journal, *Revista Mexicana de Astronomia y Astrofisica*, was the only Third World journal to make it onto the "high impact" list. This proves "yet again how much more skewed the world distribution of science journal publishing is than even the skewed distribution of wealth among nations."

According to the authors of the study, this reflects a dichotomy where "certain regions of the world such as North America and Western Europe are central and most of Asia and Africa are peripheral to the worldwide enterprise of generating new knowledge in the sciences." Often, work published in Third World countries takes more time to be noticed in industrialized countries.

The authors found that Indian journals quote a large percentage of overseas journals, making for a strongly one-way flow of scientific information. Although India publishes many scientific journals, only a few are considered good enough to be covered by the Science Citation Index, and even fewer are "world class".

"Instead of frittering away scarce resources on too many mediocre journals, India should publish a few journals of quality," the study's authors conclude.



Searching 1988: fresh water—the human imperative

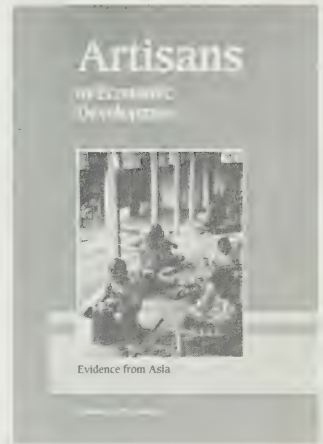
IDRC-272e, 40 pp.

Water is both friend and enemy. It sustains human beings and makes crops grow, but it can also be a destructive force, capable of eroding mountain slopes and swamping whole communities.

This year's review of IDRC activities is strongly thematic. It focuses on the role of fresh water in people's lives and the research IDRC is supporting in areas such as hydrogeology, microbiology, engineering, and information sciences.

IDRC funds research into many issues and problems related to fresh water. A group of Canadian and Mexican scientists, for example, has been probing the depths of Mexico City's subterranean layers of water-bearing rock. The researchers have found that the world's largest city is far more dependent on these "aquifers" for its domestic water supplies than previously estimated. The good news is that the aquifers are also far larger, and therefore contain more water, than geologists had earlier thought.

This is just one of several studies on urban water supplies and the threat of domestic, industrial, and agricultural contamination. *Searching* also examines the role of several innovative technologies to improve water supplies and water quality.



These include rainwater cisterns made out of wire and cement, plastic handpumps, nylon nets for harvesting coastal fog, solar stills to make saline water potable, and simple kits for testing water quality.

For a free copy of *Searching*, write to IDRC's Communications Division.

Artisans in Economic Development—Evidence from Asia

Editor: Elwood A. Pye

IDRC-262e, 125 pp.

This book examines in detail the large and heterogeneous group of workers employed as artisans. Despite the size of this work force in Asia, artisans have rarely been the subject of development-oriented research. Rapid growth of exports and competition from factory products are forcing fundamental changes on a sector traditionally responsible for creating millions of new jobs and earning large amounts of foreign exchange. Research into recent changes in this sector was carried out in Nepal, Sri Lanka, India, Malaysia, Indonesia, Thailand, and the Philippines. Economists and other social scientists investigated supply and demand issues, as well as government institutions and programs providing support. Key policy options for each country are discussed, with a view to determining how craft industries can remain viable in the future.

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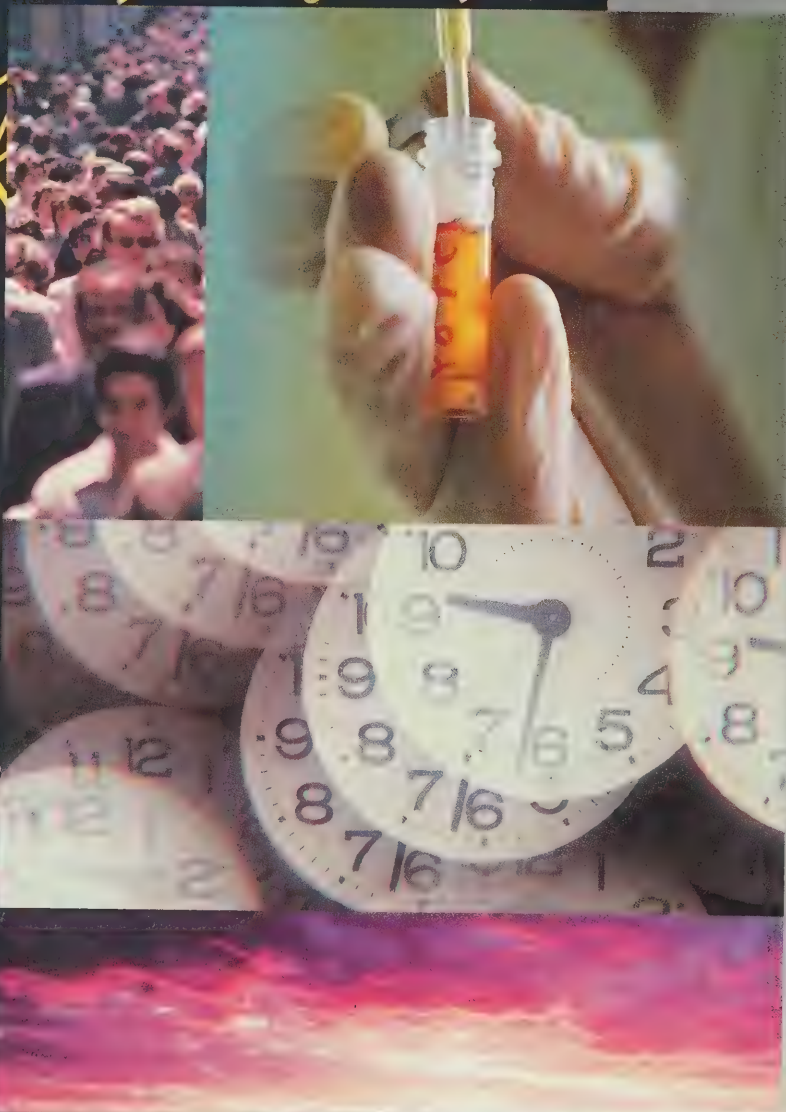
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VOLUME 18, NUMBER 3, JULY 1989

Reports

THE
IDRC



PESTICIDES IN DAILY LIFE



Letters

Unesco water project considered local needs

Your article entitled "Every cloud has a silver lining" in the October 1988 issue of *IDRC Reports* contains certain inaccuracies. First, projects were initiated in three countries: Chile, Peru, and Ecuador. Secondly, since 1980 Unesco has funded research in Chile as part of a regional program on the use and conservation of water resources in the rural areas of Latin America and the Caribbean. The project started 20 years ago under the guidance of professors Carlos Espinosa and Hector Munos of the *Universidad del Norte* in Antofagasta.

As for the pilot project in El Tofo, we wish to point out that it is incorrect to say that the water collector trials in the late 1970s, funded by Unesco in the Serena region, "were not conducted in light of the local population's needs." On the contrary, Unesco financed a study of water requirements in the Chungungo region.

Finally, Unesco's El Tofo project is carried out through horizontal cooperation. Thank you for informing your readers.

Carlos A. Fernandez-Jauregui
Program Specialist
Division of Water Sciences
Unesco

Editor's note:

The author and editors regret any inaccuracies. The article should have given proper credit to the important work carried out with Unesco's financial assistance since 1980. Without the benefit of the collector trials supported by Unesco, the IDRC-supported project would not have had the success it did. Finally, we would like to thank the research and engineering team of Corporación Nacional Forestal in zone four, at Coquimbo, Chile, for its excellent work.

The South-South connection

Edward Israel's report "Building the South-South connection" (January 1989) is a clear illustration of the potential and increasing importance of TCDC technical cooperation among developing countries.

In 1978, the UN adopted the Buenos Aires Programme of Action for promoting and implementing such cooperation. Since then, the pace of TCDC has intensified around the Third World.

TCDC attempts to overcome the attitudinal barriers to South-South exchange of skills and scientific information. It also aims to change the "developmentalist" view that the diffusion of ideas and skills and the transfer of technologies ought to be in a North-to-South direction.

South-South technical cooperation is not a substitute for assistance from the North. But it does give developing countries a measure of confidence in their capabilities and enables them to share/exchange ideas and pool resources for solving problems. IDRC should continue to fund projects that promote TCDC and reduce North-to-South technological determinism.

Chaldeans Mensah
Department of Political
Science
University of Alberta
Edmonton, Alberta

Credé Maneuver explained

In Robert Harris's article "Starting Life with Tetracycline" in the October 1988 issue, he refers to the Credé Maneuver, which is manual expulsion of the placenta after childbirth, by pressing on the uterus through the abdominal wall. It has nothing whatsoever to do with putting 0.1 percent of silver nitrate into the eyes of newborns to prevent infection with neisseria or chlamydia.

If silver nitrate solutions are kept in small individual-dose ampoules, they seldom cause harm to the eyes. If kept in larger bottles, over time the water evaporates. The solution becomes too strong and is then an irritant. Silver nitrate solution does not need refrigeration.

Solutions of tetracycline should be made up fresh every day and refrigerated. However, it is easy to neglect the making of fresh solutions in stressful situations in the Third World.

*W. Harding le Riche, M.D.,
F.R.C.P.C.
Toronto, Canada*

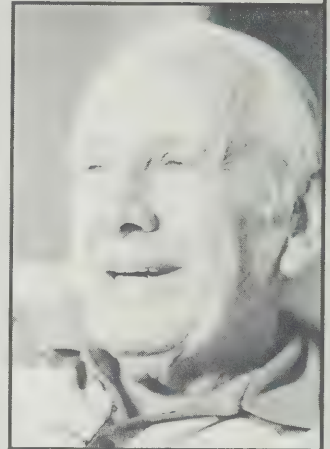
OUR LAST "REPORTS"

This is the last issue of *IDRC Reports*. We wish to thank our readers for the support they have given us over the past 18 years. Our task of spreading project results and illuminating development concerns was made easier by the cooperation of IDRC staff. To the many researchers and scientists who showed journalists around and briefed them, we extend our gratitude. And finally we appreciate the excellent work of our many freelancers and wish them the best in future projects.

The editors

THE WORLD HAS LOST A FRIEND

J. King Gordon, noted internationalist, promoter of peace and development, and pioneer of social reform in Canada, died last February 24 at the age of 88. Dr Gordon served as special advisor to IDRC from 1973 to 1980 and was a champion of the United Nations and its work. He won the Pearson Peace Medal in 1980. He was also a founding member of CUSO, a respected Canadian nongovernmental organization, and a past president of the UN Association of Canada.



J. King Gordon

King Gordon's distinguished career bridged several professions — he was a professor of political science and ethics, as well as a journalist and United Church minister.

One of the wise moves of IDRC's first president, David Hopper, was to appoint a number of older men of broad experience as "special advisers". They did not have very clearly defined jobs at IDRC. It was just hoped that they would find useful things to do and that some of their wisdom would rub off on the rest of us. J. King Gordon was one of them.

King's main job was to give advice on links with Canadian universities, and he was certainly suited for that. He had just spent 10 years in the academic world, first at the University of Alberta as chairman of the political science department and then at the University of Ottawa helping to start its institute for international cooperation. Naturally, he pushed for much closer links, and IDRC should draw more on the ideas that were afloat in Canadian universities. At the time, IDRC was most concerned to build up its support of, and acceptance by, institutions in developing countries. But King's views were later acted on.

He was a warm person with a ready laugh and a deep appreciation of world problems after 15 years' service with the United Nations in Korea, Egypt, the Congo, and New York — not to mention editing *The Nation* magazine. He always had a strong influence on people of all ages and races. Many younger recruits to IDRC had known him as a father figure in CUSO.

King himself was ever young: in his seventies he plunged into the exciting hopes raised by the UN Law of the Sea Conference, and wrote often on it.

His thousands of friends will miss him, but one thing is sure — he'll be giving the best of advice, and raising a laugh, in Paradise.

Clyde Sanger
Ottawa

The IDRC Reports is published quarterly by the International Development Research Centre (IDRC) of Canada. Its aim is to keep an international readership informed about the work IDRC supports in developing countries, as well as other development issues of interest. The magazine is also available in French as **Le CRDI Explore** and in Spanish as **El CIID Informa**.

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Cover Photo:
Carelessness causes children to be exposed to the toxic effects of pesticides on a daily basis.

Photo by Peter Bennett.



THE IDRC Reports

CONTENTS

VOLUME 18, NUMBER 3 JULY 1989

B.P. 8500

2

OUR THEME THIS ISSUE : PESTICIDES IN DAILY LIFE

Necessary but dangerous poisons

4

Pesticide poisoning is increasing along with the growing use of pesticides in the Third World.

By Gilles Forget.

Cotton's friend, sprayer's foe

6

Chinese farm workers face painful effects of pyrethroid pesticide. *By Robert Charbonneau.*

Declaring biological war

8

In India, parasites are used as a biological alternative to pesticides for controlling locusts.

By Robert Charbonneau.

Pesticides at home and work: too close for comfort

10

Carelessness or lack of information? Kenyans handling pesticides without proper precautions.

By Odhiambo-Orlale.

Women against crop pests

12

Researchers in the Philippines teach women better farming methods. *By Margarita Logarta.*

Information as antidote

13

Computerized information on poisoning helps save lives. *By Frances Delaney.*

Zimbabwe's brick granaries

14

Better granary designs help protect harvests against insects, rodents, and disease.

By Denis Marchand.

A radio script for health

16

A radio drama series teaches Indonesians proper health care. *By Melissa Hendricks.*

Mycotoxins: gremlins in your grain.

18

Scientists combat a fungus hazardous to grain crops and people's health. *By Edward Israel.*

Reliable roots...now they yield better too.

20

Better root crops bolster food supply for farmers in Cameroon. *By Lynn Teo Simarski.*

Water quality testing in the tropics

22

Cheaper, simpler tests are needed to pinpoint water contamination. *By Gerry Toomey.*

New and renewable energy: dawn or twilight?

24

A commentary on the use of energy in developing countries. *By Pierre Viaud.*

In brief

26

New Releases from IDRC

27

Canada

West Africa

East Africa

North Africa

Latin America Caribbean

South Asia

South-East Asia

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PESTICIDES : NECESSARY BUT DANGEROUS POISONS

GILLES FORGET

The year 1972 saw nearly 500 000 pesticide poisoning cases around the world. The figure for 1981 was 750 000. The problem continues to worsen. It is estimated that every year close to two million people worldwide are poisoned by pesticides, and 40 000 of them die as a result. This trend is disturbing and difficult to explain.



Nearly 85 percent of world pesticide production is consumed in industrialized countries. Yet the incidence of pesticide poisoning is 13 times higher in the Third World.

Is this the price to be paid for high performance agriculture, which increasingly relies on fertilizers, herbicides, and fungicides? Chemical imports have increased phenomenally in the Third World. From 1970 to 1980, the real value of pesticide imports increased more than six-fold.

Perhaps these figures are more of a reflection of researchers' deeper concern about poisonings of this nature. If so, the growing toll is really the result of more accurate data collection.

One way or another, the danger is real. So why continue to use such dangerous products?

Agriculture is now almost impossible without chemical fertilizers or pesticides. In the tropics, most of the soil is not very fertile. Fertilizers are a welcome adjunct. But most of the pests that undermine agriculture are also found in the tropics: rodents, insects, nematodes, fungi, weeds, and so on.

It is also in this part of the world that

populations are growing most quickly, in step with urbanization. Subsistence farming, hitherto practiced on small plots of land, is no longer adequate to feed the world. As a way out of the impasse, modern agricultural strategies must be employed, the soil must be continuously enriched, and a strict program must be established to control insects and other pests that destroy crops.

Pesticides also play an important part in most battles against diseases transmitted by insects. Programs to destroy the vectors of malaria, leishmaniasis, Chagas' disease, and onchocerciasis with pesticide sprays have been partially successful.

Unfortunately, this approach by itself presents some serious problems. It is expensive and increases Third World dependency on the industrialized countries that supply the chemicals. Nor does the propaganda stop there. The industrialized countries also suggest that the Third World adopt high-yield crop varieties that require numerous polluting inputs.

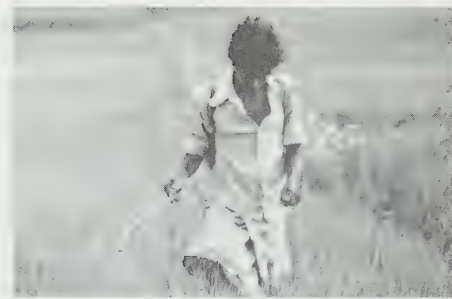
Although human health appears to be

seriously affected, that is not always true for the insects. The impressive recuperative power of insects from generation to generation is too often forgotten. In very little time, insects develop resistance that enables them to survive most insecticides with impunity!

This explains why the campaigns against malaria-carrying mosquitoes undertaken throughout Africa, Asia, and Latin America are doomed to failure. At the same time, to get around the resistance phenomenon, millions of dollars are spent every year to develop new agricultural insecticides. Since 1945, more than 15 000 compounds have been synthesized to circumvent insect resistance. These same compounds have been combined in 35 000 insecticide mixtures. Nevertheless, insects continue to ravage crops and spread disease. Ultimately, Third World consumers pay the bill.

Some developing countries, such as India and Egypt, have attempted to reduce their economic dependency on the North by asking multinational chemical

*Four thousand
Sri Lankans die
annually because of
pesticide poisoning.
A poison control centre
is trying to decrease this
number by informing
communities.*



producers to set up operations on their soil. In theory, this decision is logical. It allows the countries to produce those pesticides that are indispensable for agricultural production and the maintenance of public health, at affordable prices. In addition, jobs in pesticide plants have become a coveted source of income for workers.

In industrialized countries, businesses are controlled by strict industrial safety standards. In the case of developing countries, unfortunately, manufacturing technologies are often imported without appropriate industrial safety measures to go with them. Why? Frequently, because of economic constraints, lack of understanding of the production process, or simply because of incomplete information. Whatever the reason, the consequences can be disastrous; the catastrophe in Bhopal, India, is eloquent testimony.

It is often forgotten that pesticides are "naturally" toxic to human beings. Indeed, the most popular pesticides, the organophosphates (such as Dianizon and other products ending in similar suffixes) attack the nervous system. They were developed during the Second World War as chemical weapons, but were so toxic that neither side could bring itself to use them before the end of the war. Later, after the war, it was realized how sensitive insects were to them. It was at that point that they made their first appearance in the arsenals of farmers and public health authorities.

Health effects defy explanation

In the 1950s, we were told that everything was known about the chemical mechanisms and physiological effects of organophosphates. Had they not been studied in the laboratory? However, doctors have recently been describing syndromes related to organophosphate poisoning that defy any explanation based on current understanding of the chemistry of these pesticides. How many of these effects are still unknown? How many deaths of men, women, and children in the Third World attributed to natural causes have actually been caused by pesticides. Recent studies conducted in the Philippines by Dr Michael Loevinsohn indicate there may have been many.

Organochloride insecticides such as DDT are another important class of pesticides, although they have been somewhat displaced by organophosphates. They resist environmental degradation so

well that they are rapidly incorporating themselves into the food chain. For this reason, their use has been severely restricted. They have even been banned by many countries. However, they are still in use throughout the Third World. DDT is the best known of these. In some African countries, it is even used to protect dried fish from vermin. The problem here is not so much one of toxicity as of attitude on the part of uninformed users.

To deal with insect resistance and pesticide toxicity to people, producers have turned to new classes of compounds, often of plant origin. The pyrethrin extracted from chrysanthemums, for example, is the basis for an important family of pesticides: the pyrethroids. These compounds are less toxic to people. However, several cases of poisoning caused by imprudent use have been reported, particularly in China.

What about the herbicides used primarily in agro-industry to manage fields of coffee, sugar cane, and cotton? These may greatly facilitate crop maintenance, avoiding the necessity of weeding, but they are also highly toxic. Compounds of the phenoxyacetic acid family (such as 2,4,D, for example) are carcinogenic. However, they are widely used in the Third World.

Nearly 85 percent of world pesticide production is consumed in the industrialized countries. Yet the incidence of pesticide poisoning is 13 times higher in developing countries. These figures speak for themselves. It is imperative that the scope of pesticide poisoning be clarified and that the factors that make it such a serious problem be identified.

Third World researchers must never lose sight of the complexity of the debate. How can an expanding population be fed without harming the health of farm workers? How can the impact of insect-borne disease be reduced without destroying the ecological balance of our environment?

Epidemiological studies have shown that farm workers are the group hardest hit by accidental poisoning. This is an occupational health problem that could be solved in part by education and training programs.

Several options have been put forward to reduce chemical pesticide dependency: crop rotation, development of resistant varieties, or the use of natural predators. These methods, combined with reduced and careful pesticide use, can produce enviable harvests.

There are promising projects designed to study the natural enemies of some harmful insects. Even bacteria are being brought into play. An example is *Bacillus thuringiensis*, which can inhibit the growth of mosquitoes carrying malaria and yellow fever.

This issue of *Reports* contains accounts of several IDRC-supported projects related to the poisoning of people in developing countries and to the use of pesticide substitutes.

In China, Professor He Fengsheng is studying the health of cotton farm workers who use synthetic pyrethrin derivatives as pesticides. Despite favourable reports on their low toxicity to people, these compounds have already caused serious poisonings in Hubei Province.

In Kenya, a scientist at the University of Nairobi is attempting to clarify behaviour responsible for pesticide poisoning of farm families.

In Sri Lanka, a physician and an epidemiologist have created a poison control centre and are attempting to assess its impact on the incidence of poisoning in the country.

Two other articles deal with attempts to develop and use less harmful pest control techniques. One describes research in India aimed at using a naturally-occurring tiny parasitic organism called *Nosema locustae* to control locusts. The other examines the role of women as active promoters of "integrated pest management" -- an approach that calls for minimal pesticide use -- in farm communities in the Philippines.

In all these cases, the objectives are complementary: to sensitize governments and users by clearly describing the scope of the problem; to identify the causes of poisoning and if possible to discover appropriate solutions; and to find less toxic alternatives to the excess use of chemical pesticides.

This summary of the serious problem of pesticide poisoning should give you an idea of its disturbing scope. Above all, it should demonstrate the dedication of these Third World researchers, striving to create a better and less dangerous world for their people.

Gilles Forget is Associate Director, Health and the Environment Program, in IDRC's Health Sciences Division in Ottawa.

COTTON'S FRIEND, SPRAYER'S FOE

Chinese researchers have recently proved that one class of pyrethroid-based pesticides has toxic effects on farm workers. Their recommendations are that spraying techniques be modified, protective clothing be worn, and a program set up to educate and inform users.

ROBERT CHARBONNEAU

Professor He applies cream to a worker's face to soothe the burning sensation typical of pyrethroid exposure.



His face red and swollen, the Chinese farm worker takes a break beside the cotton field. The weather is hot, and the sweat makes him grimace as it intensifies the burning sensation in his cheeks.

It is the time when cotton plants are sprayed in Hebei Province, central China. The insecticide used is a compound of the pyrethroid family: a synthetic product that mimics the characteristics of pyrethrin, which is present in its natural state in several types of flowers, including chrysanthemums. Pyrethroid compounds are well known for not leaving any residue in the environment after 24 hours.

But the farm worker's burning sensation, caused by the insecticide, is unpleasant. "It stings!" However, the worker only began spraying half an hour ago. This evening, when he gets home, his face will still be swollen. Tomorrow, the puffiness will disappear.

This is one of the health effects exclusive to pyrethroid exposure. For the first time, a team of Chinese researchers has described the symptoms experienced by these workers and demonstrated that although this insecticide is much less harmful to health than many others, it is not entirely free of toxic effects for human beings, as the manufacturers claimed.

China imported the compounds for the first time about seven years ago. Their use spread rapidly to the cotton fields, to the point where in 1984, 13 500 tonnes of pyrethroid-based insecticides (Deltamethrin, Fenvalerate, and Cypermethrin) had been imported into China.

Pyrethroids are considered highly effective. They can kill a variety of insects in less than 10 minutes if direct contact is

made. The cotton industry hails pyrethroids for the speed with which they rid the fields of pests such as the cotton caterpillar.

These insecticides have gained popularity with users. It was claimed that they were non-toxic to people, but a research team led by Professor He Fensheng has just demonstrated the contrary. Fortunately, it appears that people who have been slightly affected by these pesticides do not suffer any after-effects from their exposure. Be that as it may, the product has been declared harmful for users who do not take the necessary precautions.

Prof. He, Director of the Institute of Occupational Medicine at the Chinese Academy of Preventive Medicine, headed a research team of more than 35 members. Their objective was to study the effects of pyrethroids on cotton workers and accurately describe the symptoms observed, so as to be able to diagnose this kind of poisoning readily. IDRC funded their work.

The unpleasant facial burning sensation experienced by cotton workers is only one of the symptoms of exposure. The sprayers also complain of nausea, dizziness, headaches, anorexia, and fatigue. In some more serious cases, involuntary muscular contractions and convulsions are observed, demonstrating that the product is certainly neurotoxic.

The researchers decided to study this occupational illness among cotton workers so that they could suggest ways of reducing the workers' exposure.

First, Prof. He wanted to revise the criteria used to diagnose serious pyrethroid poisoning so that standardized criteria could be used to carry out an epidemiological study. After reviewing

clinical reports of 573 poisoning cases in China (229 of which were work-related) between 1982 and 1988, the group made its way to Hebei Province. During the summers of 1987 and 1988, the team surveyed 3113 farm workers who were spraying pesticides containing pyrethroids. Eighty-three percent of them were using pyrethroids in the pure state, and 17 percent were spraying mixtures of pyrethroids and organophosphate pesticides.

All these workers received a structured questionnaire (based on pertinent WHO standards), and were monitored for three days following the pyrethroid spraying. Everyone who showed symptoms underwent clinical examinations that included blood and urine tests.

Statistics indicate that almost all farmers only spray for one day, three times a season. More than 80 percent of them use small pressure sprayers. Simple in design, these sprayers are carried on the back, have one nozzle and are activated with a hand pump.

Sponge-like skin

Pyrethroid vapour appears to bother factory workers more than field workers, who are contaminated primarily through pesticide-skin contact. "Of our sample, 834 individuals demonstrated symptoms," says Prof. He. "Of these, 92 percent complained of unpleasant facial sensations, burning and irritation caused by pyrethroid exposure. Many others mentioned dizziness, headaches, fatigue or nausea. In 10 cases, we diagnosed slight poisoning."

The results of the questionnaire also indicated that the sprayers were not taking the necessary precautions for handling this type of chemical. "We encountered



Upper left: Using a lid to measure pesticide often leads to a higher concentration of the chemical than is necessary. Lower left and to the right: Researchers use a tube linked to a portable instrument and gauze pads to monitor exposure to insecticide.



problems associated with lack of knowledge, poor work habits, and inappropriate techniques for using pyrethroids," says Prof. He.

Generally speaking, 70 percent of the farmers had some knowledge of the dangers to which they were exposed and of the product's toxicity. Over half of them were spraying doses exceeding the manufacturer's recommendations. The inaccuracy of dosages is partly explained by the fact that farmers use the cap of the bottle rather than a proper measuring cup when mixing the pesticide with water.

The 18 field researchers set to work, assessing the degree of contamination and the exposure of workers responsible for spraying pyrethroids. Fifty cotton workers from the townships of Gaochen and Langfrang participated in this experiment. Equipped with an air sampling device attached at the belt, each subject spent the day spraying pesticides. The workers also had gauze pads attached to their forearms and legs, under and over their pants. These pads were later analyzed in the laboratory. The researchers also took urine samples and measured climatic conditions (wind, barometric pressure, temperature and humidity) during the spraying sessions.

The results are conclusive. The chemicals often come into contact with the skin and are the primary cause of the appearance of symptoms. The urine samples demonstrated that the workers were exposed to risk and discomfort. However, there was no trace of the contaminants after 12 hours and the workers did not experience any detectable after-effects of this pyrethroid exposure.

After a day of spraying in the field, the pants and shoes of 70 percent of the

workers were completely soaked in pesticide. "This is hardly surprising," says Prof. He. "The farmers do not take any precautions when they spray. More than two-thirds of them walk between the rows of plants and spray in front of them. Inevitably, they are sometimes spraying into the wind. As they move down the rows, they come into direct contact with sprayed plants. None of them wears gloves or a mask, and more than 25 percent of the spraying equipment leaks because of inadequate nozzles or defective parts." And, continues the professor, "although it is known that the contamination is caused by product contact with the skin, 99 percent of the sprayers were not wearing socks, 73 percent were spraying with bare heads, 64 percent were wearing sandals, and only 58 percent wore long-sleeved shirts."

Recommendations

Fensheng He's team is now designing an information program for the cotton workers. It recommends safer work methods and the use of protective equipment. The research team thinks handling regulations are a necessity, and an education program must be set up in cooperation with health workers to advise the farmers (one in five of whom is illiterate) of the dangers associated with the use of pyrethroid pesticides.

The report also includes a number of recommendations for spraying. Specifically, spraying equipment should be modified to reduce or eliminate leaks. Also, spraying techniques should be refined -- for example, it might be better to spray only every second row, and sprayers should walk with their backs to the wind to reduce the possibility of spray

coming into contact with the skin. The report also noted that protective clothing, such as the polyester pants most workers wear, blocks only two-thirds of pesticides. It is recommended that sprayers wear protective plastic aprons.

The researchers also think it might be a good idea to make pyrethroid concentrates available in disposable 10-millilitre plastic bottles, thus avoiding dosage errors and protecting users against splashing. Finally, it is proposed that a review be conducted of regulations governing the production, transport, distribution, and handling of pyrethroid-based pesticides.

The researchers are particularly happy with the results obtained. One of the team members, Zhang Zuowen, underwent three months' training in data processing in Perth, Australia. Last year, he also received the President's Prize at the 12th Asian Conference on Occupational Health which took place in Bombay, India, for a paper entitled: "Exposure Levels and Biological Monitoring of Pyrethroid in Spraymen".

"In all," says Prof. He, her voice ringing with pride in work well done, "six of our articles are currently being assessed by various scientific journals." ■

For further information, consult: "Clinical manifestations and diagnosis of acute pyrethroid poisoning" in Archives of Toxicology or write to the research team in China:

He Fensheng

Director

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DECLARING BIOLOGICAL WAR

*In Africa, Asia, and the Middle East, hungry grasshoppers and locusts are a serious threat to crops. Indian researchers have recruited a tiny parasitic organism called *Nosema locustae* to assist in the fight against these age-old insect pests.*

ROBERT CHARBONNEAU

It is September 1986 in India, near the Pakistan border. A menacing cloud approaches the sorghum field, but the farmer is helpless to prevent the destruction of his crop. The cloud is a swarm of desert locusts, millions of them, covering several square kilometres -- an area too big to protect.

Although this is India, the scene could just as well be in Chad, Ethiopia, or Sudan. And the sorghum field could be a field of millet or grassland.

These insects can destroy a field in a few hours and cover a continent in their search for food. History teaches us that our ancestors have been particularly imaginative in their fight against this living scourge. They have used a variety of counter-measures such as prayers and offerings, dense smoke, and loud noise (drums and shouting). They have also resorted to unleashing starving domestic predators (ducks or chickens) to eat the insects, flooding the land, laying food traps (such as rancid butter), and even beating the ground with branches.

Unlike this armory of more or less ineffective methods, modern techniques mostly follow the hard line of destruction by spraying chemical insecticides, deadly weapons that can harm the environment.

The Indian Anti-Locust Organization had

initiated a plan for defence against the locust attack of 1986. Fifteen thousand hectares in the Bikaner and Jaisalmer districts were sprayed with 4 tonnes of malathion and 1500 litres of 18 percent dieldrin. Although these chemicals are deadly against locusts, the quantities weren't enough to contain the ravages of the swarm. Teams on the ground had to spread a supplementary 26 tonnes of 10 percent BHC, another insecticide.

Inevitably, some of these poisons find their way into streams and the food chain, threatening human health. The locust swarm will eventually die off, but this is only a respite; others will come to threaten valuable crops.

To avoid such applications of chemical insecticides, Dr Suresh Raina and his team from the Centre for Sericulture and Biological Pest Management Research Amba-vihar at the University of Nagpur in central India, have developed a biological control method for locusts and grasshoppers.

The researchers are interested in the most prevalent species, including two types of grasshoppers which attack rice, *Hieroglyphus banian* and *H. nigro-repletus*. The main locust types of interest are the desert locust, *Locusta migratoria*, and the famous pilgrim locust, the eighth plague of Egypt mentioned in the Bible, *Schistocerca gregaria*.

Locusts have varying lifestyles. Some-

times, they are solitary; at other times, they become gregarious, forming into swarms of several million. The grasshopper, however, is always solitary. The size of the insect population and certain climatic conditions are thought to be responsible for the formation of such swarms. The greater the density of insects, the greater the probability of swarms forming since food is scarce. In 1983, a population in the fields of Bhutewala in India was studied: 11 600 pilgrim locusts were counted in 100 square meters.

Dr Raina's team began its study in the rainy rice fields of Vidharba Region, east of Nagpur. Locust attacks are unpredictable and can occur at any time of year. Grasshoppers usually move into the rice fields in June, with the first monsoon rains, and stay until autumn, causing serious crop damage.

Beginning in 1984, the researchers began to monitor infestations in the States of Rajasthan and Gujarat, and in Vidharba Region, in cooperation with the Indian government's Locust Control Division. They were able to determine the degree of infestation in these regions and to verify the reproduction schedule of the insects as influenced by the climate.

The mud ridges that divide the rice fields and serve as rain collectors are a favourite breeding place. Each adult female lays 40 or 50 eggs, which withstand heat, light and bad weather, hatching only with the arrival of the next rainy season. The young insects start eating the grass growing on the ridges at the edge of the fields. Then, from the ridges to the fields is only a hop, skip, and a jump!

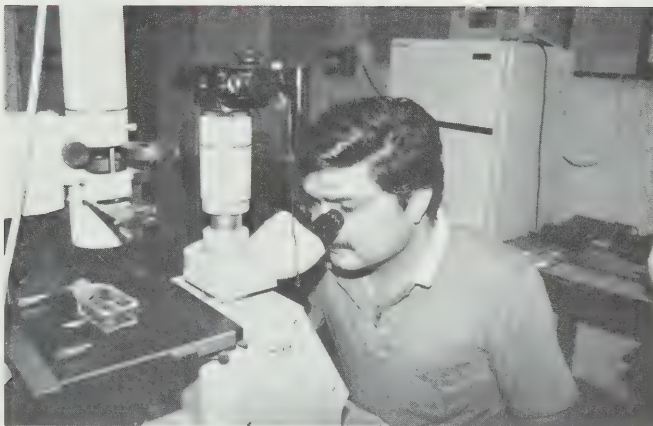
Seeking a biocontrol agent

A single-celled organism, or protozoan, called *Nosema locustae* has been identified as an internal parasite of several species of grasshoppers and locusts. In nature, about 4 percent of locusts are infected with this protozoan, which lodges in the insect's fat tissues.

The researchers have been able to extract *Nosema* spores from the host insects. They simply capture the insects in the fields, crush them, and mix the material with water. The mixture is centrifuged to separate out small quantities of *Nosema* material.



Researchers infect locusts with *Nosema locustae* in an insectarium. It has been proved that the parasite is transferred from generation to generation.



Arun Khurad tries to reproduce the parasites using the most recent tissue culture technology.

The research team chose the locust for the experiments because it reproduces more quickly than the grasshopper. In captivity, locusts can produce as many as six generations per year.

To multiply the parasite, it was necessary to infect a large number of insects reared in laboratory breeding cages. A mixture contaminated with *Nosema locustae* was sprayed on the vegetation used to feed the captive locusts. Then the technicians again centrifuged the pulverized insect bodies. By repeating the operation several times, the laboratory technicians were able to obtain strong concentrations of *Nosema* material.

This technique of *in vivo* production (whereby a natural animal body acts as a kind of living factory) is now fine-tuned. The researchers have enough of the biological insecticide, or "biocide", to spray thousands of hectares of plants. Even the doses have been worked out in the field.

A world first!

The mixture is capable of infecting about 70 percent of a locust population. But what is more important is the discovery that the parasite is transmitted from one generation to the next, which opens the door to world control of locust infestations.

Like many other scientific discoveries, this world first is the result of an accident: a group of breeding insects was inadvertently contaminated with infected food intended for the experimental group. The result was not long in coming. The researchers soon had 3000 dead locusts on their hands! Autopsies revealed the presence of *Nosema* spores. The spores were transmitted to following generations, causing the deaths of 60 to 70 percent of locusts in the eight generations studied so far. Histopathology indicated that the pathogen is transmitted through the ovary of the female. The biocide was also effective in transferring *Nosema* spores to 80 percent of the grasshopper population in a rice field where the infected females of a sprayed field may have migrated for egg laying.

To transmit the parasite into swarms of locusts, only one country along the migratory path needs to have some of its fields inoculated. The insects also carry

the *Nosema* parasite to adjacent fields where the infection level reaches 80 percent of that of the inoculated fields. From one generation to the next, 60 to 70 percent of the insects become infected in the larval stage.

Although biological methods are slower than chemicals, they are no less effective in the medium and long term. However, biological weapons are less attractive to farmers, who cannot expect immediate results from their use. This is why the researchers recognize that national and international locust and grasshopper control agencies are likely to be their major clients.

For the moment, the Indian government's Plant Protection Division has agreed to field tests. This agreement was obtained after the researchers demonstrated that the parasite had no adverse effect on bees or silkworms, the latter being the basis of a very lucrative industry in southern India. The fact that two parasites in the *Nosema* group (*Nosema bombycis* and *Nosema apis*) can infect silkworms and bees respectively had raised some fears.

"There is no doubt," asserts Dr Raina, "that these parasites, although they are related, differ in size, habits, and internal structure. In effect, *Nosema locustae* is host-specific. It can therefore only infect locusts and grasshoppers, and is not in any way prejudicial to the health or reproduction of bees, silkworms, fish or mammals."

Once beekeepers, silk growers, and fish farmers were reassured, it remained to assess the economic feasibility of *in vivo* production of the biocide.

Dr Raina says the cost of *in vivo* biocide production is "still lower than the cost of purchasing chemical pesticides to combat locusts. The effect of a biocide is slower initially, since the infection must spread throughout the population, but the medium-term effects are much more lasting than they are with chemical insecticides, since the parasite is transmitted to the offspring."

The second phase of the project is now under way. With *in vivo* production of the biocide demonstrated, the team is now attempting to grow the biocide *in vitro* (artificially in the laboratory), which would

PERSISTENT PLAGUE

The swarms of desert locusts now plaguing the countries of the African Sahel may persist even into 1990, according to a senior locust control official at the Food and Agricultural Organization (FAO).

And despite massive aerial spraying of pesticides, the locust population does not seem to have decreased significantly. This disturbing news was reported in the January edition of *World Development* magazine, published by the United Nations Development Programme (UNDP). Since the early 1960s, UNDP has provided over US\$35 million for locust surveillance and forecasting work in Africa.

During the prolonged drought of the 1970s and early 1980s, the scarcity of vegetation helped to keep the locust population low. The FAO, which monitors the movement of *Schistocerca gregaria* locusts and assists affected countries in their control efforts, traces the current invasion to Africa's good rainfall of 1985. The moisture promoted egg laying and ensured an abundance of vegetation as feed for the larvae. The insects formed into swarms that are now moving from place to place depending on the winds.

World Development also reports that the locust plague has crossed the Red Sea into the Arabian Peninsula. It adds that "for the first time on record, desert locusts were sighted in several Caribbean countries, helped across the Atlantic by the winds of Hurricane Joan."

The seriousness of the current invasion, can be partially attributed to a lack of action by some of the affected nations. *World Development* quotes a second FAO locust control officer as saying that some countries' interest in surveillance and control waned during the years of locust dormancy.

TOO CLOSE FOR COMFORT

Declaring biological war...

avoid the expenses related to maintenance of an insectary: food, labour, equipment.

The aim is to design a method for laboratory production of *Nosema* pathogen using the most recent tissue culture technology. Insect fat cells will be grown artificially and used as miniature factories for replication of the parasite. The use of such *in vitro* techniques could double the number of infected cells every six to seven days, coming close to large-scale production. Biocides such as *Bacillus thuringiensis* (BT) are already being produced commercially using such methods.

This is a difficult and critical phase of research. If the scientists achieve the results they are hoping for, enormous quantities of *Nosema locustae* parasites could be produced *in vitro* at only 50 percent of the cost of *in vivo* production using insectaries. In any case, both methods are cheaper than using chemical insecticides now on the market. This is an undeniable advantage for a large-scale anti-pest war.

Biocides have another advantage over chemicals. "After seven generations, there is no perceptible adaptation of the insect [to the biocide]," stresses Dr Raina.

In vitro manufacturing of the biocide is no easy task. The doubling time of spores *in vitro* is slow. "We are still working on manipulating the growth medium to enhance the infection and produce it economically."

The last phase will consist of comparing the relative strengths of biocides produced *in vivo* and *in vitro* and assessing which technique is more readily marketable.

In 1984, Dr Raina's assistant, Arun Khurad, visited the Forest Pest Management Institute (FPMI) at Sault Sainte Marie, Canada, where he spent six months learning tissue culture techniques. And Dr Raina himself has spent three years working in Agriculture Canada's labs at Saskatoon. In 1987, he also organized a workshop on biocides that attracted Indian participants to Nagpur.

Finally, four members of the team will soon be obtaining their doctorates for studies of certain aspects of grasshopper and locust control.

If everything goes according to plan, the new biological techniques will greatly benefit international agencies engaged in locust and grasshopper control work, as well as small farmers fearful of seeing their fields devoured in a few hours by swarms of the insects. Human beings will have at their disposal a simple, environmentally harmless, and inexpensive weapon to put an end to this scourge that has left its mark on history. ■



Most farmers say pesticides are so useful, that they can not be substituted. But these chemicals are often stored side-by-side with food and grain. Some people even store food in empty chemical containers.

Photos by Peter Bennett

ODHIAMBO-ORLALE

A small-scale farmer in Kiambu, near Nairobi, bears witness to the adage that old habits -- in his case, dangerous ones -- die hard. Mr Kimani Gathongo grows tea and coffee, potatoes, green vegetables, and tomatoes on his 1.2-hectare parcel of land. He also keeps three dairy cattle. To boost his farm's productivity, the 45-year-old farmer often uses pesticides, especially on his coffee trees.

Passing by the granary, 50 metres from his house, one finds sacks and tins of chemicals stored side by side with grain. Some of the containers contain Difolatin

80, a highly hazardous herbicide. "You know, there is not much room in my three-bedroom house to store them [the chemicals]," said Mr Gathongo, "so I have to store them there. Anyway, they are tightly sealed, so nothing can happen."

Kenya's Ministry of Health reports 700 pesticide-related deaths annually. This has spawned fears that Kenya is being used as an experimental ground for transnational corporations in the agrochemical industry. Of the 15 000 different pesticides produced in the world, 28 of them have been either restricted or banned in many countries. Among these are DDT, aldrin, dieldrin, capfatol, and paraquat, all of which have been reported in use in Kenya. The insecticide dieldrin

and the herbicide paraquat can be particularly dangerous to people, and are sometimes fatal if ingested. Poisoning with dieldrin, a known cancer-causing compound, can result in headache, nausea, vomiting, and dizziness. Ingestion of paraquat can seriously affect the digestive tract, damage the kidneys and lungs, and induce diarrhea and vomiting.

Agriculture contributes nearly half of Kenya's Gross Domestic Product. That, combined with the fact that 85 percent of the country's estimated 22 million citizens live in rural areas, makes agriculture a priority. In a move to help Kenya maintain its annual agricultural growth rate of 5.3 percent, the Ministry of Agriculture last year allocated 625 million Kenyan shillings (CA\$42 million) to buy pesticides from abroad. That represents a 50 percent increase over the 1984 figure.

Stumbling block : low literacy

At a recent dinner party organized by the Pesticides Chemical Association of Kenya in Nairobi, the Ministry of Agriculture's Permanent Secretary, Mr D.M. Namu, said, "Whereas the government greatly appreciates the use of pesticides to boost food production, the lack of education in the handling and application of them is highly regretted."

He announced the government's plans to intensify its campaign to educate farmers about the hazards of mishandling pesticides. This is to be accomplished by stationing agricultural extension workers in every district of the country. However, the campaign faces a major stumbling block -- an adult literacy rate of only 52 percent.

When I arrived at Mr Gathongo's farm I found him supervising a sprayer. The worker, who was not wearing protective garb but ordinary clothes and shoes, was spraying coffee trees with the contents of a 25-litre pesticide container he had perched on his shoulder.

Mr Gathongo enquired about my health and the weather in Nairobi, and conducted me on a tour of his farm. "I usually buy my pesticides at the stores of the Kenya Grain Growers Co-operative Union (KGGCU) either in Kiambu town or in Nairobi," Mr Gathongo said. "But when I am broke I go to the nearby cooperative stores or the local market and buy them there."

We visited the open-air market in his village. Several of the traders scooped chemicals from sacks clearly labeled with instructions and precautions, and repackaged them in smaller tins. The traders wore no gloves, masks, or protective clothing. Rather than transferring instructions from the sides of the sacks onto the tins, the traders simply told the farmers how to use the chemicals.

The Kenyan government has issued a directive that all agrochemicals must be labeled with instructions in both English and Kiswahili. More often than not, this regulation is ignored.

Mr Gathongo, who dropped out of school in standard seven, gives the chemi-

cals nicknames. He calls copper oxychloride, the chemical he uses most on his coffee trees, "Gitomo", the Kikuyu word for insect.

Mr Gathongo, his wife, six sons, and two daughters, use empty agrochemical containers around the house. "I will not lie to you that we have not been told by the health and agricultural officers and extension workers not to use them," says the farmer. "But, you see, the truth of the matter is that we cannot afford to buy new ones. So how do you expect us to throw away these ones?"

In a recent two-year study funded by IDRC, it was found that most farmers in the Githunguri area of Kiambu District use pesticides regularly and extensively on their food crops, especially on their coffee trees. Mr Mutuku Mwanthi and Mrs Violet Kimani, researchers in the community health department of the University of Nairobi, assessed the extent of mishandling of chemicals in Githunguri because it is close to Nairobi, and because it is a highly agricultural area.

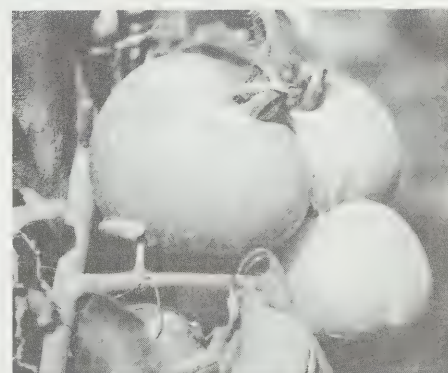
The researchers found that the only precaution farmers in the area take with hazardous chemicals is to keep them out of the reach of children. "Due to the lack of knowledge on the part of the farmers using the agrochemicals, their extent of exposure is very high," they said in their report.

Harmful chemicals were found stored side-by-side with foodstuffs and grain in several homes visited by the researchers. In other homes the empty chemical containers were being used to store edibles and drinks. When asked what they thought about pesticides most people said the chemicals are 'very useful to us and we do not think that they can be substituted'.

The research team met many people at the nearby health centre suffering from pesticide related ailments such as skin irritation, asthmatic attacks, hypertension, constant headaches, and diarrhea. Coffee sprayers were particularly hard hit, and the team branded them the "high-risk group" because of the long hours they spend handling the chemicals. (In a separate study not funded by IDRC, Dr K. Kimani of the University of Nairobi's department of medical physiology found that after only two hours of chemical spraying, the average coffee sprayer shows evidence of a 20 percent reduction in lung capacity. Some coffee sprayers work 30 to 40 hours a week.)

The IDRC-funded researchers assessed attitudes, behaviour, and general awareness of health hazards posed by improper use of chemicals. They designed a health education curriculum based on on-the-spot interviews with farmers. "Now that we are about through with the first part of our study, we would like to use the information we have already gathered to give feedback to members of the community in Githunguri," explained Mr Mwanthi. "This we can then use to try to get them to intervene and participate in the educational program."

Meanwhile, as concern for the proper



Pesticide handling is often done with improper care, since people either lack information or protective equipment. The powder irritates the skin. It also can lead to yet another form of toxic poisoning through vegetables that have not been adequately washed.

care and handling of pesticides continues to grow in Kenya, the country's watchdog on the pesticide menace, the seven-year-old Pest Control Products Board (PCPB) is plagued by understaffing, and lacks the means to test chemical safety.

If Kenya is to achieve the twin goals of increasing agricultural output and caring for the health of workers and farmers, government authorities will have to ensure that Kenyan farmers are well versed in the proper use and handling of pesticides. This can only be achieved through a concerted, long-term regional approach.

Odiambo-Orlale is a journalist with the Daily Nation newspaper in Nairobi.

WOMEN AGAINST CROP PESTS

INTEGRATED PEST MANAGEMENT IN THE PHILIPPINES

MARGARITA T. LOGARTA

Rural women in the Philippines are slowly beginning to realize that they actually do 'hold up half the sky'. Studies indicate that women are vital participants in rice farming.

Although they provide less than one-fifth of the actual labour needed for rice production, they have a major role in decision making on the farm. For example, besides running the farm household, bearing children, and augmenting the family income, they also make important decisions about the purchase of agrochemicals.

A recent project funded by IDRC shows that these women can act as effective agents for the adoption of integrated pest management (IPM) -- an environmentally and economically sound way to control agricultural pests (see box).

Under the project, Filipina researchers introduced IPM to five communities in Calamba, Laguna, 50 kilometres south of Manila. "At first, the men denied any participation of their wives in the farming process," observes Dr Candida B. Adalla, an entomologist working on the project. "But in further discussion, some revealed that the women were responsible for choosing and buying pesticides during their trips to market."

Dr Adalla and her predominantly female staff from the nearby University of the Philippines at Los Banos found such information significant. "More than ever, it convinced us of the need to educate women as well as the men," she says.

Two groups of cooperators participated

in the experiment: 51 rice farmers working 80 hectares, and 26 vegetable growers cultivating seven hectares. The fields were divided into experimental plots for testing IPM and 'control' plots (for comparison) where current farming techniques, including liberal use of pesticides, were followed.

The farmers actively managed both IPM and control plots, but they were required to consult the project staff before applying pesticides in the IPM control area.

For IPM to succeed, certain conditions must exist. One Filipino agriculturist described these as "all the right type, all the right amount, all in the right sequence, all when the stage of the plant, the weather, and the pest are right to achieve significant control for the least cost". Like most technologies, IPM must be fine-tuned and adapted to specific locations.

In considering their results after the first year, the researchers agree the project is succeeding and should continue. "IPM practices began to greatly influence the farmers' way of thinking," says Dr Adalla. "If they didn't spray in the IPM plot, they wouldn't spray the non-IPM plot as well."

More than three-quarters of the rice farmers obtained higher yields in the IPM portion. If not for a series of bruising typhoons which struck the Philippines last October, IPM yields could have been even higher, say the researchers.

More IPM experiments are currently being conducted on the vegetable plots since last year's results proved inconclusive.

A much misunderstood technology, IPM was initially seen by people as risky. Cooperators were difficult to attract. "We

were cynical about the project," Mereng Manzanero, a woman rice farmer, admitted. "We had been the victims of too many government projects in the past. Researchers came and went without even telling us of the results of the experiments."

Alejandro Muya, a school teacher who also manages a farm, said, "We thought that any insect had to be eliminated. We didn't know that 'friendly insects' help destroy pests."

Project coordinators won over the farmers by promising to reimburse them for whatever differences in returns between the two plots. Aware of the people's fears, Dr Adalla and her colleagues quickly established their presence in the communities. "We worked with them in the fields, lecturing and demonstrating IPM," she recalls. Their efforts paid off. "The people praised us for being *ma-charisma* (convincing)," she chuckles.

The staff employed various methods to bring the IPM message to the farmers and their families. They held regular meetings to share ideas and problems. Since few women attended the sessions because they were busy with household chores, the staff visited them at home to solicit their opinions.

The researchers also learned that the women were eager for new ways to earn extra income. Seminars in mushroom culture, accounting, and beekeeping were arranged. And now there are plans to organize a cooperative store stocked with basic goods such as soap, canned food, and coffee.

A team of communicators, headed by Dr Teresa M. Stuart, developed a four-week

HITTING THE ENEMY FROM ALL SIDES

Integrated Pest Management (IPM) is fast becoming a popular alternative to the widespread -- and often indiscriminate -- use of chemical pesticides in agriculture.

IPM controls pests using a combination of techniques -- biological control (using the natural enemies of a pest as weapons against it), special cropping patterns, and the planting of pest-resistant varieties. Chemical pesticides also have a role in IPM, but they are used minimally.

The hit-them-from-all-sides approach of IPM has proven effective in lowering the risks to human health and the environment that pesticides pose. It has also led to higher yields and profits for farmers.

"A beautiful ecological balance between prey and predators in rice ecosystems has evolved over centuries," said Dr Merle Shepard at a recent briefing in Washington for representatives of international agricultural research centres. Dr Shepard is former head of the entomology department of the International Rice Research Institute in Los Banos, Philippines. "Pesticide misuse upset that balance in many areas. But researchers hope to restore it through integrated pest management."

In Asia, four countries have adopted IPM as official policy on crop protection: the Philippines, Indonesia, India, and Malaysia. "Wide scale IPM adoption should reduce pesticide use on rice by 50 percent," according to Dr Shepard. That could save the Philippines about US\$5 to 10 million per year, and Indonesia as much as \$50 to \$100 million.



IPM advocates frequent monitoring of fields to reduce spraying of chemicals.



Education of field workers is the key to spreading integrated pest management techniques. Photos by Arthur de la Rosa.

radio course on IPM. The program aired before the project was implemented in May 1988. More than a thousand farmers enrolled. "Most often their wives would sit beside them while they listened to the program," says Dr Stuart. The regular radio program *Balitang Pambukid* (*Farm News*) over station DZLB continues to provide supportive information and motivation for IPM cooperators and other clientele.

IPM activities were documented through pictures and video tape and exhibited at every opportunity. "It made the people feel good to see themselves on screen," says Dr Stuart. Under her supervision, students of development communication designed an informative comic book, leaflets, and posters on IPM.

The staff hit upon the idea of creating IPM 'scouts' when many farmers complained that monitoring pest populations and recording it with paper and pencil took up too much of their time. (Some farmers pleaded poor eyesight!) Thus, seven young boys, aged 12 to 15, were trained to do the job for four pesos (about 22 Canadian cents) an hour.

Puppets for IPM

Dr Stuart's team also produced a puppet show on IPM entitled "The Verdict", the story of a farmer who files a court case against insect pests. A one-day puppetry workshop was subsequently conducted for the scouts to groom them for future presentations.

When it comes to making agriculture a healthier and more profitable profession, it seems clear that women and youth can be successful agents of change, permanent change. Mereng Manzanero, a mother of two, is one whose life has been so touched. "IPM has truly been a big help to us," she says. "Even if Dr Adalla and her group were to leave this place tomorrow, we would still continue to use IPM."

Margie Logarta is an investigative reporter with the Manila Chronicle in The Philippines.

INFORMATION AS ANTIDOTE

FRANCES DELANEY

The curly-haired boy in his striped pajamas slept peacefully. What misfortune could have brought him to this hospital bed in Cairo? The shocking response was that this eight-year-old Egyptian had attempted suicide by poisoning. But he would survive, as would the two-year-old who arrived in her mother's arms a few moments later, the victim of an accidental ingestion of pills.

These children were among the lucky ones. They had been brought to the Cairo Poison Control Centre where a team of qualified clinical toxicologists works with limited resources to save lives. In this busy city of 12 million people, the centre has a herculean task to perform, but it has only 14 beds at its disposal. In 1988, it treated more than 3600 people for poisoning.

Six thousand kilometres to the southeast, in the Indian Ocean island nation of Sri Lanka, physicians grapple with the same problem. More than 25 000 poisoning cases two-thirds of them from pesticides and many of them attempted suicides are admitted to the country's state hospitals every year. Now the second leading cause of death in hospitals after heart disease, poisoning takes the lives of nearly 4000 Sri Lankans annually.

On the other side of the globe, staff of the *Centro de Información y Asesoramiento Toxicológico* (CIAT) in Montevideo, Uruguay, worry about the growing problem of poisoning. The number of cases now numbers more than 6000 annually an alarming rate for a country of only three million people.

The rise in the incidence of poisoning in the developing world coincides with the increasing availability of pharmaceutical, industrial, and agricultural chemicals of both foreign and domestic origin. For countries whose economies are dominated by agriculture, poisonings are mainly the result of overuse and misuse of pesticides and fertilizers. In many instances, the daily users of such agrochemicals are illiterate or containers are labelled in a language other than their own.

Physicians treating poisoning victims need ready access to detailed information about the substance ingested. It can mean the difference between life and death for their patients. An estimated 60 000 man-made chemicals and one to two million products that are mixtures of these chemicals are in common use in the industrialized countries. It is impossible for a physician to remember all the toxicological details of even a tenth of these products. Yet in many developing countries, where information on chemicals and appropriate treatment is not so readily available, it would appear that perfect recall is expected of physicians.

Fortunately, more and more countries are recognizing the importance of ready access to information such as the names, composition, manufacturers, and management of the toxic substances in their own markets.

In Sri Lanka, the National Poisons Information Centre was set up by the government in 1986 at the General Hospital in Colombo with financial assistance from IDRC. It has already compiled several thousand "index sheets" on various poisoning agents. Recently the centre acquired a microcomputer which will streamline the compilation and provision of relevant data.

IDRC support will also enable the Cairo Poison Control Centre and CIAT to strengthen their poison information service to health professionals and communities. In turn, this will increase public awareness of the threat of poisoning.

But what about other countries that may want to establish their own poison information centres but are short of resources? To address this, IDRC is supporting the establishment of a poison information package for developing countries. The project is coordinated by the International Programme on Chemical Safety of the World Health Organization, in cooperation with the Canadian Centre for Occupational Health and Safety and the *Centre de Toxicologie du Québec*.

The package, to be produced in English, French, and Spanish, will consist of monographs on the major generic substances commonly involved in poisonings, guidelines for collecting and storing information about the local situation, and a standardized format for recording case data. Both computerized and hard copy versions will be produced.

The war against poisoning in the developing world is an arduous one. Arming doctors and communities with the right information at the right moment helps save lives. In the long run it will also make for better informed communities generally thereby preventing poisonings from happening in the first place. Then, little children will sleep peacefully at home in their own beds rather than in hospital.

Frances Delaney is a senior program officer with the IDRC Information Sciences Division

ZIMBABWE'S BRICK GRANARIES

PUTTING THE FOOD SUPPLY ON A SOLID FOOTING

DENIS MARCHAND

Experts almost always stress agricultural production (improved farming methods, soil fertilization, and combating disease and parasites) as the way to solve the problems of poor diet or undernourishment," says Campbell D. Kagoro, an engineer at the Agricultural Technical and Extension Service (Agritex) in Zimbabwe. "Unfortunately, they only rarely mention the importance of reducing post-harvest losses."

Mr Kagoro has worked for many years on the development of a new type of granary. Reducing food losses during storage remains his number one priority.

ENDA-Zimbabwe (Environment, Development, Activities) has joined with Agritex to undertake a major study of the subject, with financial assistance from IDRC.

In Zimbabwe, grain losses during storage aren't a big problem for large commercial farms owned by rich families. On the other hand, such losses continue to be a serious problem in the traditional com-



Corn piles up outside the newly-built brick granaries that protect the harvest from losses due to rodents, insects and disease. Photos by Denis Marchand.



Engineer Campbell D. Kagoro, of the Agricultural Technical and Extension Service, says grain losses pose a serious threat to communal farms which compose 42 per cent of arable land in Zimbabwe.

munal agricultural areas that feed most of the rural population. These areas, where farmers grow maize, millet, and sorghum, occupy about 42 percent of the country's arable land. For the most part, they are located in semi-arid regions prone to drought and erosion and degradation of soil.

In 1985, according to Agritex figures, communal lands produced 771 000 tonnes of maize, 190 000 tonnes of millet, and 78 000 tonnes of sorghum, representing respectively 50, 90, and 92 percent of national production.

Most small producers are subsistence farmers and store their harvest in small granaries with a capacity of 1.5 tonnes.

It is estimated that 10 to 20 percent of this grain deteriorates during storage. The financial losses are enormous, but these are insignificant compared with the threat to the country's food self-sufficiency.

This is why ENDA-Zimbabwe undertook in 1986 to replace the traditional mud-

These brick structures, covered with a waterproof thatch roof and equipped with air vents, offer excellent protection against dampness. Each has an average capacity of 2.5 tonnes and up to five compartments to store various types of products.



Traditional wood and mud granaries are vulnerable to erosion. Grain losses are estimated at 10 to 20 percent annually.

covered wooden granaries with new structures developed by the Institute of Agricultural Engineering (IAE) and Agritex.

The ENDA granaries have been installed in disadvantaged, arid areas. They are built with bricks laid directly on gravel-covered soil or on rock. In some instances, the structures are built on wooden joists supported by masonry footings.

The wood floors are covered with a mixture of mud and mortar ("daga"), with sand added to prevent cracking and dung to repel rodents.

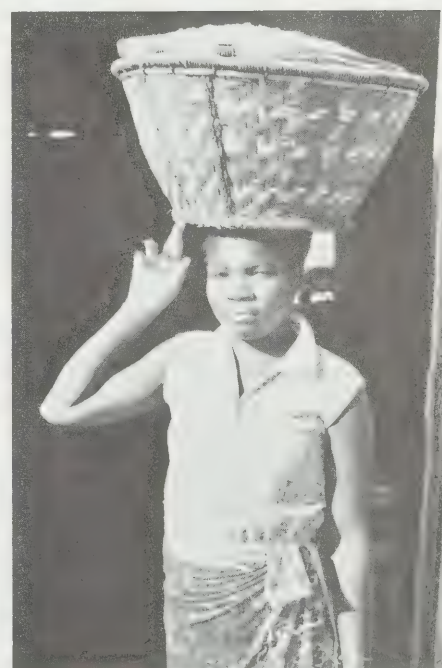
These brick structures, covered with a waterproof thatch roof and equipped with air vents, offer excellent protection against dampness, insects, and rodents. Each has an average capacity of 2.5 tonnes and up to five compartments to store various types of products.

Their brick composition is no accident. This material is a viable alternative to wood which is becoming increasingly

scarce in densely inhabited regions where deforestation is occurring. In addition, the manufacture of baked clay brick is a familiar process for the local residents. They already use this material to construct their homes.

Granary construction is part of a larger ENDA research project to develop new storage and drying methods. "The dilapidated condition of the traditional granaries is not the only cause of loss," says ENDA-Zimbabwe's director, Charles Gore. Insects, parasites, and insufficient drying also cause a great deal of damage. Nevertheless, the improvement of the granaries will greatly reduce annual losses."

Denis Marchand is a freelance Canadian photographer and journalist interested in development issues.



According to Agritex, communal farms provide 90 percent of the national production of maize.

A RADIO SCRIPT FOR HEALTH

In Indonesia, where infant mortality rates are among the highest in Southeast Asia, a health group is using radio to send a message to families -- hygiene, nutrition, and immunization save lives.

MELISSA HENDRICKS



Is Hendra and her two sons in their home in East Jakarta. The task of educating communities about family planning and child health has presented an enormous challenge to radio series producers.

Photo by Melissa Hendricks.

Sumi and her husband, Madi, are arguing heatedly with their parents about childhood immunization. Sumi wants her baby to be immunized. The grandfather sides with Sumi. Adamantly opposed to this idea, the baby's grandmother says, "Immunization is dangerous -- the baby will get a fever from the injections."

This conversation introduces an episode of the Indonesian radio drama, *Kisah Sumi Dan Madi* (The Story of Sumi and Madi). Like many radio serials, this program chronicles a family's life through its fights, laughter, and quiet conversations. In 26 episodes, Sumi and Madi fall in love, plan their future, get married, have a baby, and begin the process of raising their child.

Unlike the typical radio soap operas, *Kisah Sumi Dan Madi* also teaches lessons about family planning and child health. In the episode described here, Sumi tries to convince the grandmother that immunization is safe for children by describing how it prevents killer diseases such as diphtheria, tetanus, measles, and polio. Sumi eventually wins the argument and brings the baby to be immunized. At the program's end, the narrator reminds the audience that immunizations are effective

only if children receive booster vaccinations.

In other episodes, the family talks about a variety of health-related topics. As Sumi and Madi prepare for marriage, they debate family planning options. When Sumi gives birth, the family discusses the advantages of breastfeeding over the use of baby formula. When the baby gets sick, the family administers Dralit, the salt and sugar solution given to prevent dehydration from diarrhea.

Kisah Sumi Dan Madi was developed by Yayasan Kusuma Buana (YKB), a private nonprofit public health education organization, with financial assistance from IDRC. The series covers six key health issues: family planning, breastfeeding, oral rehydration therapy, personal and community hygiene in parasite control, child nutrition and growth monitoring, and childhood immunization. The project's coordinator, Dr Ieda Peornoma Sigit Sidi, says, "Mother's knowledge about these six key areas can help decrease infant and maternal mortality rates."

Crucial information

This information is crucial to Indonesia which has one of the highest infant mortality rates in Southeast Asia. For every 1000 babies born, 87 die as infants. The

maternal mortality rate is also high. For every 100 000 women giving birth, 450 die in delivery.

Health problems are especially severe for Indonesia's children. Of the approximately 21 million children under the age of five, about six million are malnourished and 15 million suffer from vitamin A deficiency. Many others are afflicted with preventable diseases such as parasites.

In a health clinic for low- and middle-income groups supervised by YKB, Adji Setijoprodjo helps direct an ambitious program that examines every Jakarta schoolchild for parasites. He says more than 60 percent of schoolchildren in Jakarta test positive for parasitic worms. Children contract the worms by drinking contaminated water or through food and soil, he explains.

YKB executive director Dr Firman Lubis sees overpopulation as the underlying cause of infant mortality and childhood disease. Despite a trend toward smaller families, estimates of the fertility rate still range from about 3.2 to 4.0 children per family. This rate could increase Indonesia's population from its current 175 million to 263 million by the year 2025. Dr Lubis calls family planning and child health "two sides of the same coin".

"Education about family planning can lead families to have better health and improved quality of life," he says. "This is especially significant in urban areas, which have higher infant mortality rates."

In impoverished sections of cities, dilapidated houses lie crammed together with no open areas between them. They border on rivers filled with fecal matter and garbage. Children play in streets strewn with rags, rotting food, plastic bottles, and mud. They defecate and play in the same roadside areas.

Iis Hendra lives with her husband and two boys in one of Jakarta's poorest neighbourhoods. The children have only the narrow streets in which to play, and spend much of their time in the family's one-room house. The dimly-lit three-meter-square room contains a bunk bed, a crude sink, and a chair. Ms Hendra says her husband works in a factory, but his job is only temporary and in a few days he will be unemployed. Massive movements of workers from rural areas to the cities have created large numbers of urban unemployed and forced many families into poverty.

Since 1980, YKB staff members have worked toward improving health care and family planning for low- and middle-income families in cities by strengthening communities' self-sufficiency in these areas. YKB has established six clinics like the one in which Mr Setijoprodjo is employed. It has distributed posters, pamphlets, and written material, and conducted information seminars on low-cost measures for health care and family planning. The task of educating communities about family planning and child health has presented an enormous challenge to YKB.

Indonesia is spread over vast distances, often with little contact between villages. Its population is large and culturally diverse and a large percentage is illiterate.

Through surveys conducted by scientific and social science research groups, Dr Peornoma Sigit Sidi sought the most feasible means of communicating with this population. The surveys found that radio is the most popular form of mass media in Indonesia. Radio production is also preferable to television production because it is cheaper and is broadcast more frequently than television. Also, while the country has only two television stations, it has more than 400 private radio stations.

An even bigger challenge was to design a program about child survival that would appeal to the target audience (poor and middle class women with children under age five), and to do so on a limited budget.

To attack this challenge, Dr Lubis says, YKB staff had to depart from accustomed methods of health promotion. "In the past," he says, "old, balding professors would promote breastfeeding in a very dry, formal manner. We feel we have to develop attractive advertising with messages such as, 'Breastfeeding is modern and a lot cheaper than using infant formula.'"

"Another problem is that we have to compete with companies that have bought expensive songs and know good advertising strategies."

Dr Lubis and Dr Peornoma Sigit Sidi thought if a radio station could include messages about health within the context of a mini-drama, a form of entertainment popular with housewives, the series would attract and educate a large audience. Several station managers told YKB they were interested in developing more educational programming. "Radio stations felt guilty because children knew the song for promoting MSG, but did not know about important health issues," says Dr Lubis.

YKB contracted Radio Kayumanis, the most popular radio station in Jakarta, to help write and produce the program. Located at the centre of one of Jakarta's poorest neighborhoods, Radio Kayumanis broadcasts to the targeted groups YKB hoped to reach.

After writing and casting the episodes of *Kisah Sumi Dan Madi*, Radio Kayumanis then taped and aired the episodes. Each segment is 15 minutes long.

Before broadcasting the program, YKB previewed the first six episodes before audiences of housewives and working women from Jakarta. Dr Peornoma Sigit Sidi reports that the women in the pilot audience not only understood the key messages, but they also enjoyed the serial. She says the women asked for longer programs and they suggested future episodes include information about child education, side effects of contraception, and problems in husband-wife relationships.

Dr Peornoma Sigit Sidi also learned that the best times to broadcast the series are in the morning so that housewives can do their housework while listening, and again in the early evening, for working women.

After the pretest, Radio Kayumanis broadcast the programs over the course of a month, running each segment twice each day. YKB conducted a post-broadcast survey of 1025 mothers of children under age five to learn how many women had listened to the broadcasts. The results indicated that 15 percent of those women

heard at least one episode. Apparently, in densely populated Jakarta, one radio is heard by many. "One respondent reported that Jakarta is so dense she can hear the program from her neighbour," Dr Peornoma Sigit Sidi says.

With the help of a national social research firm, YKB also conducted surveys of Radio Kayumanis listeners both before and after the month-long presentation to evaluate the program's effectiveness as an education tool. Overall, the results indicate that *Kisah Sumi Dan Madi* improved women's understanding of the health issues.

A promising finding was that the number of women aware that the Indonesian government is promoting the ideal number of children as two increased from 75 percent to 93 percent. In other findings, slightly higher numbers of women were aware of the need for tetanus toxoid vaccination for pregnant women and of specific immunizations for young children. There was also an increase in awareness of the need to administer a special sugar/salt solution for dehydration.

While these results show only small changes, Dr Peornoma Sigit Sidi believes they are significant. Larger changes probably require a program running longer than one month. "Twenty-six episodes are really only the beginning," she says.

Kisah Sumi Dan Madi has aired beyond Jakarta and YKB has made the program available at low cost to all radio stations in Indonesia. At a workshop on child survival, the Indonesian Private Radio Association gave the serial tapes to 14 of its members from provinces thought to have especially high infant mortality rates. Quizzes conducted after the tapes were aired on stations indicate that *Kisah Sumi Dan Madi* is as popular in the provinces as it is in Jakarta. Several of the stations suggested the program be translated into their area's local language.

YKB hopes to attain private sponsors for programs promoting child survival. Several companies have already expressed interest in the projects.

Dr Peornoma Sigit Sidi says she plans to continue helping radio stations produce shows with child survival themes. But both she and Dr Lubis believe *Kisah Sumi Dan Madi* should serve as a model and should encourage radio stations to produce their own, similar programs. "Our philosophy," says Lubis, "is to get the community to help itself." ■

Melissa Hendricks is a freelance reporter based in Washington D.C.

GREMLINS IN YOUR GRAIN

*A Canadian team of agricultural scientists is on the lookout for grain varieties resistant to a fungus called *Fusarium*. The fungus cuts grain yields and the toxins it produces are a serious hazard to the health of people and livestock.*

EDWARD ISRAEL

It was in 1987 that some 50 000 people in the Kashmir Valley fell ill after eating bread. In as little as 15 minutes, their abdomens ached, their throats became sore, some vomited, others suffered diarrhea.

Luckily, there were no reported deaths. That year, the wheat harvesting season in this valley of northern India was unusually rainy. Some of the grain developed a mould and ended up with a furry, pink halo. The infected grain was mixed half-and-half with uncontaminated wheat and then the mixture was milled and sold to local bakers and consumers who later fell ill.

When technicians analyzed the locally baked bread, they discovered it contained *Fusarium* fungus and mycotoxins, the toxic chemicals produced by the fungus.

Such mycotoxin poisoning is not limited to India. The incident is one of many reported worldwide. In China, for example, smaller-scale, but more toxic outbreaks have occurred. However, mycotoxin poisoning in human beings is rarely fatal.

Fusarium, known as head blight in wheat, occurs wherever maize, wheat, and other cereal crops are grown. When it

infected soft wheat in Ontario, Canada, in 1982, much of the crop was downgraded from human to animal feed.

The fungus and resulting toxins not only reduce crop yields and cause human health problems such as weakened immunity, but also adversely affect livestock growth and reproduction. Although the fungus causes losses everywhere, it is the developing world that should be most wary, for most of its inhabitants get 80 percent of their calories directly from grain.

Dr J. David Miller, research scientist at the Plant Research Centre of Agriculture Canada in Ottawa, has been studying *Fusarium* mycotoxins since 1982. At that time researchers knew of about five toxins produced by *Fusarium graminearum*, a common fungus. Today there are several dozen known mycotoxins, most discovered at Ottawa's Plant Research Centre. A team of 30 scientists, working for eight years, now understands the complex biochemical mechanisms responsible for the production of two of the mycotoxins -- deoxynivalenol (vomitoxin) and zearalenone.

Funded by IDRC, Dr Miller obtained germ plasm (reproductive plant material such as seeds) of different varieties of

maize, wheat, and other cereals from China, Brazil, Argentina, and Mexico. The material was provided by the International Maize and Wheat Improvement Center (CIMMYT) in Mexico and Chinese collaborators.

Dr Miller hopes to identify genetic characteristics associated with resistance to the fungus. His goal is to design a kit for plant breeders such as scientists at CIMMYT to determine which varieties in their gene banks are resistant to *Fusarium*. Eventually CIMMYT, which provides germ plasm to countries around the world, will be able to furnish *Fusarium*-resistant seed.

Over the centuries, grain and maize plants' ability to resist *Fusarium* has been decreased in the process of selective breeding for desirable traits such as higher yield and quality. The crops are increasingly unable to withstand humid growing seasons.

The mycotoxins produced are extremely potent. If one were to make flour or animal feed from 1250 ears of corn, for example, a single severely-infected ear would be enough to make the mixture toxic to pigs or human beings.

After consuming even lightly con-



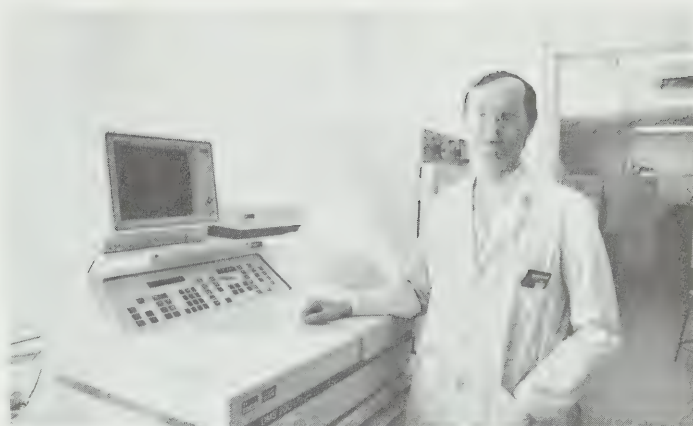
These littermates were fed equal amounts of feed. The smaller one ate *Fusarium*-contaminated feed.

Photo by Agriculture Canada.



A Fusarium-infected ear of corn. Twenty to thirty such ears can contaminate an entire acre.

To the right: Dr J. David Miller at The Plant Research Centre in Ottawa.



taminated plants, human beings and animals are "immuno-compromised", although precise long-term effects are difficult to measure. Moderate contamination causes severe headaches, dizziness, vomiting, and symptoms like those in the Indian 1987 outbreak. More acute poisoning occurred in China in 1984-85, where 463 people ate mouldy cereal, and felt its noxious effects in only five minutes. In more serious cases, scientists have discovered, people develop intestinal tract ulcers, and some *Fusarium* toxins cause cancer of the esophagus, which is potentially fatal since eating becomes impossible.

The toxins are found on the outside of the kernels. This is very troubling for the large number of developing countries in which the whole grain is commonly consumed. Further, most of the toxins are unaffected by the heat of cooking.

In farm animals, particularly pigs, the effects of mycotoxins can be easily detected. After Dr Miller discovered he could manufacture mycotoxins in a laboratory fermenter, Dr Locks Trenholm of the Animal Research Centre conducted feeding trials to determine the effects of the pure toxins in the diets of pigs.

Between two littermates, one pig was fed contaminated grain, the other uncontaminated grain. After seven weeks, the one eating the infected food was only about half the size of her littermate who had been eating the healthy diet.

"Pigs can tell if there's one or two parts per million of vomitoxin," explains Dr Miller. "We need a machine that costs CA\$60 000 to find out." Pigs' extreme sensitivity means they will often resist eating contaminated grain.

Although it is safe to eat animals that have been raised on contaminated grain, their slow growth poses a dilemma. "Consider that in the Third World people get a much higher percentage of their calories from eating grain directly. This may be what happens," says Dr Miller, pointing to the skinny pig in a photo of the experimental littermates.

Farmers may also choose to divert some of the infected grain to feed animals. But

then, instead of needing four or five kilograms of feed to achieve one kilogram of weight gain in the pig, they will need six, eight or ten kilograms. "It will take twice as much feed and therefore take away twice as much of the food supply for the people."

Chinese reports indicate that in bad years the *Fusarium* problem is so serious that Yangtze Valley fields turn pink, the colour of the fungus. The Valley has suffered outbreaks of head blight every two years, on average, for the last 30 years. In some fields, crop loss is as high as 40 percent.

Fusarium also poses a serious threat to the health of farmers during handling. "Inhalation exposure is the most efficacious way to get a dose of toxin," says Dr Miller. When ingested through the lungs, some mycotoxins are more toxic than potent nerve gas.

Chinese join the team

The work of Dr Miller and his team will likely benefit countries with serious *Fusarium* infestations. Last year, a Chinese researcher, Mrs Wang Yu Zhong, vice-director of the plant protection centre at the Jiangsu Academy of Agricultural Sciences, joined the team in Ottawa for a year. During her stay she mastered the procedures for identifying resistant germ plasm and laboratory techniques for analyzing toxins in Chinese strains of *Fusarium*. In China she will continue research to determine which mycotoxins are hazardous to people and animals.

For the time being, the best farmers can do is to follow good agronomic practice. That consists of keen observation and taking measures to reduce the risk of head blight. Farmers can have their livestock feed analyzed for toxins. If it's contaminated, they can dilute it with uncontaminated feed. In their fields, farmers should avoid repeatedly planting crops susceptible to *Fusarium* infection, such as wheat and corn. Crops should be planted early to avoid simultaneous growth of weeds, such as quack and barnyard grass, both of which host *Fusarium*.

For planting, farmers should select unin-

fected or fungicide-treated seed since infected corn and wheat seed may produce infected plants. Planting corn in lower densities allows more aeration and sun exposure to prevent infection.

Since autumn weather is ideal for the growth of other mycotoxin-producing mould, farmers should harvest when the crop is ready. After harvesting, ploughing virtually all crop debris into the soil ensures bacterial decomposition of *Fusarium*-bearing material. While crop debris is the major source of *Fusarium graminearum*, soils, seeds, grasses, and spores carried by air, insects, and birds are potential sources. Protecting harvested corn from rain, drying it after harvest, and the use of mold inhibitors also discourage fungal growth.

As research continues, new mycotoxins are being discovered and the field of toxicology is becoming more complicated. The most recently discovered *Fusarium*-generated chemical compound, or "metabolite", comes from Malaysia, produced by fungus growing on sorghum. "They found a toxic fraction. It was sent to us and two weeks later we discovered what it was. It turns out to be a new class of metabolites not known from any of the other related *Fusaria*," says Dr Miller. "And this from a food product."

Dr Miller's goal is to have a kit for breeders available in the next year or so. It would be like a litmus test, turning a solution pink when mixed with material from a *Fusarium*-resistant plant. Knowing which plants are resistant will help breeders eliminate the susceptible varieties.

But the task of regaining the lost resistance in grains is a greater challenge. Observes Dr Miller: "Once you lose resistance, it's a 15-year job to get it back up. And even with the intense effort we're making now, we might be able to cut that 15 years into 8 or 10. Resistance is the worst thing to lose."

Edward Israel is a freelance writer based in Ottawa.

RELIABLE ROOTS ...NOW THEY YIELD BETTER TOO



Farmers, like this man, are working with scientists to test crop lines in the fields.

Photos by Lynn Teo Simarski.

Small farmers in Cameroon are bolstering their food supply and income by planting improved varieties of cassava and sweet potato. In some areas demand for planting material has shot ahead of supply. The local researchers behind this root crop bonanza ascribe their success to intensive collaboration with both the farmers and an international agricultural research centre in Nigeria.

LYNN TEO SIMARSKI

Root crops are grown in every province of Cameroon's diverse landscape -- from the hot, humid evergreen forest fringing the foot of Mount Cameroon, to the vast northern savannah. Cultivated for their carbohydrate-rich, underground storage organs, root crops furnish half the country's major food crop species, although they were slighted until recently by agricultural research.

"We are a nation of agriculturalists," says the director of Cameroon's Institute of Agronomic Research (IRA), Dr J.A. Ayuk-Takem, pointing out that the mainstay of Cameroon's root crops production, like that of other food crops, is the small-scale family farm. Root crops are a reliable

source of food in an uncertain climate and even tolerate drought well. This helps explain why subsistence farmers depend on them so heavily.

Until a few years ago, the woman trekking long distances to her cassava fields in the forest, the yam cultivator in the northern savannah, and millions of root crops farmers in between, had no choice but to grow traditional low-yielding crop varieties that fall prey to pests and diseases.

The Cameroon National Root Crops Improvement Program (CNRCIP) was created in 1977 as the country's first national food crop program. It has begun to turn the situation around for farmers, at least for several target crops: cassava, cocoyam, yam, and sweet potato.

Irish potato was added recently to the program. New varieties and growing practices are beginning to boost production for Cameroon's expanding population.

The International Institute of Tropical Agriculture (IITA) in Nigeria has close ties with agricultural scientists in Cameroon. It has provided them with superior plant genetic material for their breeding work, as well as training courses, access to research networks, and technical experts.

Two donors, IDRC and Belgium's Agency for International Development and Cooperation (AGCD), funded the program's early development, along with Cameroon's Institute of Agronomic Research. As the program matured, the Institute assumed a greater share of the cost. Recently, Britain's Gatsby Charitable Foundation has underwritten the effort to distribute new varieties to farmers.

Under the root crops program, farmers participate in the research process right from the beginning. They are surveyed by the scientists to determine their needs and, later, they test crop lines in their fields and let scientists know the results.

"The policy for government researchers many years ago was 'don't interfere with farmers'," recalls Dr Simon Lyonga, national coordinator of root crops research. "We were struggling to solve farmers' problems without involving them. There was also the evident gap between research results and farmers. Our results were confined to offices and drawers."

Seeing through farmers' eyes means focusing on many factors. These include not only technical constraints such as rainfall, climate, and soils, but also local settlement patterns, authority structures, and



Cameroon scientists in a multiplication field of sweet potatoes, near Ekona Research Station in the forest zone.



An Adamaoua woman dries cassava pulp in the sun to preserve it.

eating habits. All of these affect the degree of acceptance of new technologies. Many types of cassava, for instance, require laborious processing to render them edible. But people in central Cameroon might not welcome such varieties even if productive, because their custom is to simply peel and boil most of their cassava. Only 30 percent of cassava is made into other products.

Perhaps the single worst obstacle to expanding root crop production is slow multiplication. Unlike cereals or legumes, which farmers grow from seed, root crops are propagated vegetatively from "planting material" -- stems, vines, or tubers of the parent plant. This slower process often limits how much a farmer can plant, and retards the dissemination of improved varieties. New rapid multiplication techniques promise to help overcome the propagation bottleneck.

At this point, it is mainly CNRCIP's cassava and sweet potato lines that are beginning to pay off in farmer's fields. Improved cassava varieties can yield 100 to 300 percent better than the best local types in the country's diverse zones, while new sweet potatoes IRA 1112 and TIB 1 yield twice as much or more than local varieties, on average, across five different ecological zones.

More than 1000 farmers and extension workers have graduated from CNRCIP courses on root and tuber production. They have helped to disseminate the new root crops to farms in some of Cameroon's most isolated plateaus, and even to neighbouring countries.

One region where the new varieties are catching on is the forest belt spanning south and central Cameroon, and com-

prising about one-third of the country. Root crops supply 60 to 70 percent of dietary calories in this zone, with cassava alone accounting for 44 percent of the total.

"There's more demand for the new cassava varieties in this region than can be supplied," says Ekona Research Station agronomist Dr Jerome Ambe Tumenteh. The station recently held a root and tuber workshop for 17 female community development leaders from seven provinces. They returned home with samples of improved cassava and sweet potato to multiply in their areas. "The women were surprised to see the disease-free material and how quickly the cassava had bulked (produced tubers)," he says. "In fact, there was a scramble over planting material when they were leaving because of limited space to fit it on the bus!"

One of the trainees, an extension worker, took stems of new cassava varieties to Muyuka, a nearby small town. There, Mary Njuma, president of a group of 50 women farmers, convinced her group to pool their labour to plant a common multiplication field. Each will eventually take some stems to multiply on her own farm.

Ms Njuma says her group likes the new cassava types' ability to mature faster than old types (in 10 months instead of 12), as well as their high yield and resistance to disease. The women also appreciate the new cassava's denser canopy cover, which shades out weeds and reduces the tedious work of weeding. Ms Njuma registers only one complaint about the new varieties: planting material has been quietly disappearing from the field, as

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CAMEROON'S MAJOR ROOT CROPS

CASSAVA In Cameroon's forested south, cassava is a major food crop. It can be cultivated on leached tropical soils and grown last in a crop rotation, when soil is considerably exhausted. It has the singular capability of remaining viable underground for up to three years as a hedge against hunger.

COCOYAM Two types of this large-leaved root crop -- macabo and taro -- are grown throughout Cameroon. The crop performs best, however, in the higher rainfall areas.

YAM Cameroon lies in West Africa's yam zone, which produces 90 percent of the world's crop. Yams must be staked to yield properly. Unfortunately, stakes are sometimes unavailable in wood-depleted areas of the savannah.

SWEET POTATO This root crop was once considered suitable for consumption only by livestock or children. But cultivation is increasing as knowledge of its nutritional value spreads. Two crops of sweet potato per year can be grown in the forest area of Cameroon.

WATER QUALITY TESTING IN THE TROPICS

...Reliable roots

other farmers see its performance and help themselves.

In the savannah of northern Cameroon, root crops play more of a backup role in case of crop failure. In the Adamaoua region, however, where dark volcanic crags overlook expanses of plateau, cassava is still the primary carbohydrate staple. The area's population of semi-sedentary livestock herders had been neglected by food crop researchers until CNRCIP turned its attention northward in 1981, with IITA assistance.

In just a few years, improved sweet potato varieties became the first new food crops to be distributed in the region. They were enthusiastically acclaimed by farmers for their high and stable yields, resistance to disease and weevils, and good taste. In 1985, the program also began distributing three improved cassava lines, which yield 25 to 50 percent better than local types.

"Nothing passes 'em!" a farmer near Ngaoundere, Adamaoua's largest town, tells visitors about the new sweet potatoes. He says that he and his neighbour, to whom he passed planting material, now grow the crop for commercial sale -- a change from the past, when farmers grew the low-yielding local varieties mainly for home consumption.

The outreach approach of Cameroon's root crop scientists gives them a thorough grasp of the country's different growing regions and the varying needs of farmers. Agricultural scientists from around the country all agree on the importance of networking as a way to ensure that improved varieties reach remote farms. This means keeping in touch with government extension workers, influential farmers, village chiefs, local farmers' groups, religious missionaries, and representatives of parastatal organizations.

CNRCIP's campaign to distribute new varieties and train farmers in new technologies is now in full swing. The scientists believe, though, that success is not measured only by the number of cassava stems distributed or extension agents trained. "It's also a question of attitude," explains Malachy Akoroda, an IITA scientist in the Cameroon program. "If we sensitize farmers so they're eager to take our varieties, then we have created the potential for rapid change in the future." ■

Western-style lab tests for determining drinking water quality are a major problem for many developing countries. They are usually too expensive, too complicated, and inappropriate for rural areas where most people live. A network of researchers from several developing countries is now examining promising alternative tests that are cheaper and easier to administer.

GERRY TOOMEY

In villages and cities around the world, new wells, pumps, reservoirs, latrines, and sewage systems have been installed during the last decade in pursuit of the goals of the International Water Decade. But unless these water sources are protected from contamination and proper monitoring and maintenance procedures instituted, all these efforts will have been in vain.

Among the ingredients of a realistic program to assure water quality are simple tests for determining microbiological properties of water, and a scheme for classifying water sources according to their health risk to users.

Few developing countries, however, have enough lab space, equipment, chemical supplies, or trained personnel to carry out the sophisticated water-quality tests routinely done in the industrialized world. Long incubation periods and lack



Technicians collect water samples to test for coliphage. Small amounts of dried E. coli, nutrient medium, and a gelling agent are combined in a twenty-millilitre water sample.





Researchers at the University of Malaya in Kuala Lumpur use an insulated water container that keeps the water sample at the right temperature for incubation. The kit was designed for use in cool mountain villages.

of quick transport of time-sensitive samples to the lab are added hurdles.

Because of these factors it often takes a serious outbreak of waterborne disease to push officials into action -- an approach not unlike closing the barn door long after the horse has bolted.

Unrealistic safety standards also pose a problem, since developing countries have difficulty meeting international criteria for the microbiological and chemical quality of water. If they were adhered to, many water sources, especially ones that rural people depend on, would have to be closed down. For this reason, "Ministries of Health tend to allocate too few resources to water quality control programs," says a recent report on an international water-quality research project funded by IDRC.

Researchers have been examining several simple, inexpensive testing techniques to see whether they are suitable for use in developing countries. They have been assisted by experts from the National Water Research Institute, part of Canada's Ministry of the Environment.

The project was formulated following a 1983 seminar in Singapore sponsored by IDRC. Last February, representatives from eight countries -- Brazil, Peru, Chile, Egypt, Morocco, Thailand, Malaysia, and Singapore -- met in Ottawa with U.S. and Canadian water quality specialists to review their progress.

The microbiological quality of water is tested for bacteria known as coliforms, including ones of fecal origin. In particular, the presence of the bacterium *Escherichia coli* is generally considered to be an indication of fecal contamination. This, however, has been called into question following the recent detection of naturally occurring *E. coli* in tropical soils known to be free of fecal matter.

The presence of fecal coliforms like *E. coli* -- found in the bowels of human beings and other mammals -- signals the possible presence of other dangerous bacteria, viruses or parasites transmitted by people. Both fecal coliform counts and total coliform counts are used to assess the potability of water.

Existing tests for detecting coliforms are based on sophisticated and expensive technology, often requiring water samples to be incubated for a long period. In Malaysia, for example, the coliform test kit currently used costs over US\$3000. At that price, each district can afford to test rural community water sources only about once a year.

A simpler alternative for testing water quality is to detect "coliphages" -- viruses that accompany coliforms and prey on them. A Malaysian research group is designing an inexpensive, portable kit based on this technology. (See box.) One recommendation from the Ottawa meeting was to improve the sensitivity of this promising water test.

The international network of researchers are also investigating other tests. Two of these -- the hydrogen sulphide (H_2S) test and the Presence/Absence (P/A) test -- are highly promising.

In the H_2S test, a paper strip in a tube is incubated for one to three days. If undesirable bacteria are present, they will produce hydrogen sulphide which darkens the paper strip.

Researchers at the Ottawa meeting reported that the H_2S test has a long shelf life, is the least expensive of the tests and the easiest to perform. They recommended it be modified into a "quantitative test", that is, one that indicates the degree of water contamination.

The P/A test, in which a water sample is mixed with a special broth medium and incubated overnight, was found useful for testing treated water where minimal contamination is expected. Like the H_2S test, though, it would be more useful if it were a quantitative test.

An encouraging finding of the research group is that the coliphage, P/A, and H_2S tests all appear to give good results even when incubation is done at ambient temperatures -- between 20 and 30 degrees -- rather than at the standard 35 degrees. The research group has recommended field evaluation of the tests to set these technologies on a firm track for future application in developing countries.

The coliphage test kit

Dr Wang Chee Woon, associate professor of biochemistry at the University of Malaya in Kuala Lumpur, Malaysia, has been developing a simple coliphage-detection kit as part of the IDRC-sponsored water quality research network.

He says the kit is much simpler and more economical than commercial kits and it permits more water points to be tested for microbiological quality. It is designed for use by rural communities and Ministry of Health personnel, and can be used by anyone with three years of high school education.

Dr Wang and his colleagues initially tried the coliphage technique on 200 water samples. Then they produced and tested the first prototype kits, each capable of handling eight samples. A second kit, with a 10-sample capacity, is now in the works.

A major advantage of the coliphage test is that the incubation temperature of the water sample is relatively low: 27 to 31 degrees Celsius, which is just above room temperature. Standard coliform tests, on the other hand, require a temperature of 35 degrees. The latest kit design contains an insulated water sample holder for use in cool, mountain villages.

The tiny disks of filter paper hold the specially dried *E. coli* host bacteria, extending its shelf life to upwards of three months. The mixture is poured into four petri dishes and left overnight to incubate. Round clear spots (or "plaques") in the dishes indicate areas where the host bacteria have not grown because of the presence of coliphages. The larger the number of spots, the more coliphages there are in the water sample, thus indicating contamination with fecal coliforms that include *E. coli*.

Gerry Toomey

NEW AND RENEWABLE ENERGY: DAWN OR TWILIGHT?

PIERRE VIAUD



Energy sources such as this solar cooker in Kenya, are usually inappropriate for use by people in developing countries.

New energy sources. Soft energy. Renewable energy. Alternative energy. Non-conventional energy. Over the past two decades the industrialized countries have discussed and launched programs under a variety of such energy headings, stimulating remarkable enthusiasm which quickly spread to developing countries.

But for most people interested in this field, the first impression is certainly one of real disappointment. One of the first 'mistakes' with respect to new and renewable energy (NRE) has undoubtedly been the confused and ambiguous way in which it has been introduced to future consumers. It has been presented as 'new', but aside from photovoltaic cells, a spinoff of space technology in the early 1960s, none of the 'new' energies is really new. Wind, sun, and biomass have been used by human beings for eons.

'Renewable' energy? This term is also misleading, since it is necessary to differentiate between various energy sources. On the one hand, there is solar, wind, hydraulic, tidal, and geothermal energy, which can justifiably be characterized as 'renewable'. On the other hand, there is biomass, which is only renewable under extremely restricted operat-

ing conditions. In this regard, it is surprising to describe gasohol as a renewable energy source. Only plant photosynthesis is renewable; the rest is renewable only if its management is economical and far-sighted and if production can keep up with consumption.

Another ambiguity about NRE: in Western societies, sun and wind have connotations of holidays, leisure, and freedom from care. On the other hand, the implementation of these energy sources is extremely labour-intensive and difficult, often producing reduced efficiency and performance.

Along the same lines, the label 'free' that is often attached to solar energy is misleading. Despite the immensity of the resource, the operating investment is often very costly.

Advertising campaigns surrounding the launch of NRE undoubtedly did more harm than good. They would have been perceived otherwise had they been accompanied by finished, reliable, and good-quality products. The validity of NRE has always depended on self-teachers engaged in "enlightened tinkering" (in the best sense of the word) and on prototypes or "pre-production" series in limited distribution, with necessarily reduced reliability.

There is always a tendency to refuse to allow NRE efforts the necessary time for

thought, trials, maturation, and development – stages that other energy sources benefited from before being introduced for public use. History teaches us that the period required to set up and master the conventional energy sources was about a century for coal, 50 years for petroleum, and 30 years for nuclear energy, with an accumulation of knowledge and considerable intellectual and financial backing already in place at the vital moment.

Throughout the developing world, the rush to install prototypes that should never have left their technological cocoons has certainly damaged NRE significantly. How many broken-down solar installations, windmills, photovoltaic panels, or biogas digesters are there in the developing countries, abandoned after a few days or months of operation?

Contrary to some people's opinion, this does not prove that these systems are inefficient or unworkable. At most, it points to a lack of foresight in setting up the projects, a lack of project maturity, and a surprising lack of training for those expected to install, manage, and maintain the equipment.

In light of these failures, the importance of being familiar with the energy-consuming communities should be emphasized. As surprising as it may seem, it becomes rapidly

"This haste to set up prototypes has certainly damaged New and Renewable Energy significantly."

apparent that it is not possible to determine who is consuming what and how. For example, it is generally accepted that Sahelian populations consume 500 kilograms of wood per adult per year. In principle, data of this nature should make it possible to estimate the consumption and consumption pattern of a country, village, or family. But in reality, the major unknown is the capital and labour cost of this energy, since supply and consumption scenarios differ greatly.

The Sahelian populations, estimated at 40 million in 1985, are, generally speaking, divided into two separate societies. Rural people, depending on the country, make up 60 to 90 percent of the population; urban and peri-urban people make up the other 10 to 40 percent.

In the rural environment, biomass from trees – in the form of firewood or, less often, charcoal – accounts for most energy consumption. Wood is gathered at varying distances from dwelling places and is quite inexpensive, since labour, work time, and travel are not accounted for.

Most of the activities are powered by human energy alone, estimated at several dozen watts per person per eight-hour work day. Obviously, total energy expenditure is extremely low, and this is the critical link in any development project.

This rural situation will not be changed by massive commercial energy projects, but by the provision of a reasonably sized power system (about a kilowatt) along with appropriate methods for harnessing and using it (draught animals, machines and tools, communications, acquisition of knowledge, etc.).

Except for one or two litres of oil per lamp per month and a few radio batteries, very little commercial energy is consumed in the bush. The mere construction of a 30-megawatt plant is not going to change this.

Although self-sufficiency in fuel for cooking, household needs, and craftspeople is more or less achieved, clearly the total absence of mechanical energy is the limiting factor blocking development. Most agricultural policies have hit on this snag.

In the towns, energy consumption is entirely dependent on established commercial distribution systems for firewood, bottled gas, and electricity. But this energy is very ex-

pensive, sometimes amounting to over 50 percent of a family's budget.

Experts do not see any viable substitute for wood in developing countries before the end of the century. In the short term, the only efficient measures involve savings. By using improved furnaces, household consumption could rapidly decrease by 30 to 40 percent, without lessening comfort. Most of the Sahelian countries have attempted to develop programs to distribute better stoves, but it must be admitted that they are not raising any enthusiasm among the Sahelian populations, whose psycho-sociology is unfamiliar to us.

A multinational corporation or an informed businessperson would never risk marketing an innovation without a serious study of the target population. But in the majority of NRE cases, new products are proposed or installed without prior study, when what is required is detailed and thorough psycho-socioeconomic information on the populations concerned.

The nature of political regimes in Africa varies from one country to the next – mark the differences between Senegal, Ivory Coast, Burkina Faso, Congo, and Tanzania, for example. For a spectrum of countries there is also a spectrum of policy options. It should be noted, though, that among this diversity, no government in the past decade has managed to set up an effective energy management or substitution policy.

Outside factors, such as dropping oil prices, have also affected NRE negatively. A solar facility that was amortizable over seven or eight years in early 1985, when oil sold for \$32 a barrel, required over 25 years to make a return on investment in July 1986 when oil was only \$10 a barrel, and 16 years in July 1988 when oil was \$16 a barrel. If NRE is really to be developed, the first requirement is a firm political will that won't be swayed by changing economic circumstances.

We are currently in a situation where energy consumption far outstrips production. To make up the discrepancy, reforestation efforts must increase 15- to 20-fold over their present levels. But reforestation must not be presented as a possible solution to the energy crisis. New solutions must be considered. Imagination must play an essential part, and

any proposal, no matter how bizarre, deserves study.

As a counterpoint to the above, strong emphasis must be placed on the well known insufficiency of NRE research and development credits. The scattered credits granted to NRE in numerous institutes, laboratories, and teams working in the South and the North are just as regrettable as the ridiculously low sums of money devoted to this research.

It would be dangerous to centralize NRE research in a few large regional or international institutes, in the name of savings and efficiency. And it is regrettable that the numerous researchers involved are not able to meet and work together once or twice a year.

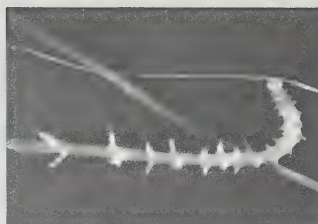
What would have been the situation if research into automobiles early in the twentieth century had been confined to one company? Would we have the diversity of high-performance, economical models we do today?

NRE development work should concentrate more on a systems approach than a single-track approach, complete with various forms of technology transfer, appropriation, and adaptation to specific local needs. Hence these tasks should be broadly decentralized and compared and contrasted on a regular basis.

For millennia, humankind has experienced continuous fluctuations that have altered the stability of the systems in which they were evolving. Today, new factors are giving current instabilities dimensions that have been unknown until recently. Examples include exponential demographic growth and increasing gaps between levels of energy consumption. Simple changes in scale cannot re-establish the system's stability. It will be necessary to define and implement radical new solutions.

Pierre Viaud teaches in the physics department of the Université de Tours in France. He has been a professor at the Université de Dakar and director and founder of the Laboratoire de valorisation des ressources naturelles, which he created in 1979 at the École nationale supérieure universitaire de technologie (ENSUT), in Dakar.

In Brief



Striga shown attaching itself to the root of a crop. Striga grows on maize, rice, millet, sorghum, and cowpea – the staple foods of about 300 million people in Africa.

Best option against parasitic weed:

breed resistant crops

Striga, a parasitic weed, is the archenemy of millions of farmers, mainly in dry areas of Africa and Asia. In sub-Saharan Africa, it is responsible for more than 40 percent of annual crop losses.

Agricultural scientists recently concluded that the best way to combat the devastating effects of striga is to breed new crop varieties resistant to it. At a week-long conference on striga in Nigeria, they agreed that planting resistant crops would be more effective at fighting the weed than using expensive, hard-to-handle herbicides, and hand weeding, which is time consuming. They recommended research be done to find fast screening methods to identify strains resistant to the weed.

Striga attaches itself to the roots of maize, rice, millet, sorghum, and cowpea – the staple foods of about 300 million people in Africa. Also known as "fireweed", "witchweed" or "wutawuta", it robs its host plants of nutrition, and flourishes as they shrink, wilt, and die off.

Striga has infested those areas of the Sahel and Sudanese savanna that have, for many years, been plagued by drought and locust invasion.

"Farmers often break down in tears while some others have abandoned their farms as a result of the devastation caused by striga," says Dr S.T. Lagoke, of the Food and Agriculture Organization. The value of total annual cereal crop losses due to striga is estimated at US \$7 billion.

The experts recommended a combination of methods to control the weed until striga-resistant crops are available. These include clean weeding of farmers' fields, hoeing and burning of the weeds before flowers mature, deep ploughing, crop rotation, and the planting of "trap" crops such as cotton and soybean between rows of susceptible crops. The use of fer-

tilizer, manure, and selective herbicides was also suggested.

"But one control measure that would be more beneficial to African small-scale farmers," said Dr S.K. Kim, a maize breeder for the International Institute of Tropical Agriculture (IITA), "is that research centres should breed crops resistant to striga."

The conference, jointly organized by IDRC, IITA, and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), commended IITA's screening for striga-tolerant hybrid maize varieties that are now grown commercially in Nigeria.

In Burkina Faso, IDRC is funding researchers who are breeding striga-resistant varieties of sorghum and millet. IDRC is also supporting the testing in Sudan of striga resistance in sorghum and research in India and West Africa on the effects of soil moisture, temperature, and fertility on germination and growth of striga.

Beth Thompson

Africa's biocontrol program gets a new home

The International Institute of Tropical Agriculture (IITA) in Ibadan, Nigeria, has a new facility to help it fight crop pests such as insects and weeds. The ultra-modern Biological Control Centre opened last December in Cotonou, in the West African country of Benin. Its job is to develop environmentally safe methods for the control of crop pests in Africa.

The US\$4.6 million complex, provides training facilities for 30 scientists, graduate students, and extension workers. Thirty-five research institutions from around the world are participating in the Biological Control Program, as are most African national programs.

Supported by 12 donor countries and organizations, the new centre in Cotonou will house IITA's biocontrol program which benefits 10 million hectares of Africa's cassava belt. The program tries to help control

pests such as the cassava mealybug and green mite which cause annual crop losses of 30 to 80 percent.

IITA researchers have been fighting cassava mealybug and cassava green mite since 1979. Cassava, brought to Africa over 500 years ago by the Portuguese, is now the staple food crop of over 200 million people in West Africa. In fact, cassava provides 50 percent of the caloric intake of Africans, says Dr Hans Herren, director of IITA's biocontrol program for Africa.

The cassava mealybug and green mite are found in 28 of 35 cassava-producing countries in Africa. These insect pests were inadvertently brought to Africa in the early 1970s from Latin America.

IITA scientists say chemical pesticides cannot be used to kill these pests since cassava leaves are often eaten as vegetables, and pesticide management is difficult and costly for farmers. The only alternative has been biological control – using the natural predators of these pests as a weapon.

"We use nature's equilibrium to keep pest levels under injury levels," says Dr Herren.

In 1981, Dr Anthony Bellotti of the Centro Internacional de Agricultura Tropical (CIAT) in Colombia discovered that *Epidinocarsis lopezi*, a parasitic wasp found in Paraguay, was a natural enemy of mealybugs. After several years of testing, the wasps were brought to Africa, and vials filled with *E. lopezi* were released from aircraft into African fields.

Since then IITA has distributed *E. lopezi* over 1.5 million square kilometres of Africa. In many cases, this has reduced the cassava mealybug population to a level where it no longer causes significant damage. "We just hope the farmers don't start spraying for other pests," says Dr Herren, "because then they'll kill the wasp and we'll be in trouble again." But Dr Herren is optimistic. He predicts that "Africa's mealybug problem will be under full control in the next three to five years."

IITA's biocontrol program has

also undertaken studies to control pests that attack maize, cowpeas, citrus, and mango trees, and it is working to control African desert locusts. (Indian researchers are also investigating biologically safe ways to control locusts. See page 8.)

Ania Wasilewski

Conserving wild plants

Ensuring food production keeps pace with population growth is a critical task for the world's farmers. Their success rests on humanity's ability to protect a diversity of the wild species related to the world's main food crops, says a recent publication entitled *Conserving the Wild Relatives of Crops*.

Barley, wheat, maize, squashes, peppers, beans, and potatoes have lost their ability to compete in the wild since the first farmers gathered and sowed their seeds between 7000 and 10 000 years ago. Crops have become genetically uniform, making them vulnerable to epidemics of pests and disease. They can, however, benefit from having the traits of their wild relatives bred into them. Wild varieties have evolved to withstand pests, diseases, and poor growing conditions.

Yet conserving wild species is technically difficult, and they are largely neglected by agronomers and breeders.

Conserving the Wild Relatives of Crops written by Erich Hoyt, was written to appeal to the public and to prompt governments and other agencies to intensify their efforts in conserving crop genetic resources.

The International Board for Plant Genetic Resources (IBPGR) collaborated with the International Union for Conservation of Nature and Natural Resources and the World Wide Fund for Nature to produce this book. For more information:

IBPGR Headquarters, c/o FAO
Via delle Terme di Caracalla,
00100 Rome, Italy

Beth Thompson

New Releases

Alley Farming in the Humid and Subhumid Tropics: Proceedings of an International Workshop held at Ibadan

Editors: B.T. Kang and L. Reynolds, IDRC-271e

An urgent challenge facing scientists working on upland food-crop production in many parts of the humid and sub-humid tropics is the need to find viable, sustainable, and environmentally sound alternatives to ancient cultivation methods such as bush-fallow and slash-and-burn cultivation systems.

Alley farming is a food-cropping and livestock-production technology that requires a low level of input and helps conserve soil resources while sustaining long-term farm productivity.

This publication presents the results of an international workshop on alley farming in the humid and subhumid tropics. Held in Ibadan, Nigeria, in March 1986, the workshop was attended by 100 participants from 21 countries.

This book reviews the present state of alley farming research and its application, discusses the use of woody species in tropical farming systems, highlights training and research needs, and proposes the establishment of channels for collaborative research.

Techniques for Collection and Analysis of Data on Perinatal Mortality in Kinshasa, Zaire

D. Nzita Kikhela, IDRC-61e

In developed countries, mortality rates are well known and have declined sharply since the 19th century. But in Africa, such rates are injectural, making in-depth research on this topic necessary. Only with such research will it be possible to identify the components of a good social and health policy.

The methodological findings of a study in Kinshasa from 1981 to 1986 are presented here as a step toward the better study of mortality in the young. These findings focus on three topics: data gathering, the preparation and/or application of a conceptual framework, and the determination of which families are at risk.

In data gathering, experience in Kinshasa brought to light many precautions that should be taken, notably in the selection of those carrying out the enquiry, in the formulation of questions, and in seeking out people to be interviewed in an ongoing enquiry.

A methodology for establishing a conceptual framework is proposed, with careful attention given to the variables necessitated by its use and their importance.

Lastly, an appropriate methodology is presented for determining families at risk. This methodology is not novel. However, we believe that by presenting its possibilities, its use may be favoured in developing countries where the design of an effective policy requires, as a prerequisite, the identification of the target groups.

Sharing Knowledge for Development: IDRC's Information Strategy for Africa

IDRC-TS64e

Financial and human resources available in Africa and among donor agencies such as the International Development Research Centre (IDRC) are limited and can be used most effectively within an explicit strategy. Such a framework of objectives and programs must be consistent with sub-Saharan Africa's own priorities and existing infrastructures for research and information.

With input from African specialists, the Information Sciences Division of IDRC has developed a strategy for support to information systems, networks, and services. The plan aims to benefit as many people as possible, and to increase support to the high priority activities and needs that have been identified.

The major objectives of the strategy for Africa are fivefold: first, to encourage sharing of information and to promote standards and compatibility among national and regional information systems; second, to improve the capacity among African nationals for planning and implementing information and informatics policies and increase the use of local experts in information handling; third, to promote participation of poor people by supporting information systems that address local problems, and improve access to relevant information; fourth, to build human resources in information sciences and sharing knowledge produced in sub-Saharan Africa; and, fifth, to ensure that information initiatives are sustainable.

Entrepreneurs in Education: Canada's Response to the International Human Resource Development Challenge

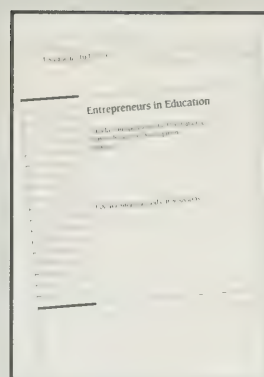
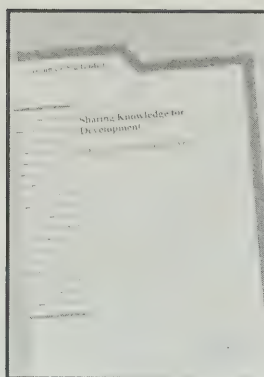
Donald Simpson and Carol Sissons
IDRC-TS62e

This study highlights the changing world of human resource development (HRD) and explores possible responses from private- and public-sector organizations in Canada. Its key message is that unless Canadian institutions are prepared to consider new approaches to program development, financing, and organizational structures, developing-country institutions looking for Canadian assistance and aid agencies requiring Canadian capacity to deliver their programs, will be faced with a major resource problem.

To increase and improve the international HRD capacity of Canadian institutions, there needs to be changes in attitudes, structure, and financing.

This study looks at how market forces are affecting HRD activities and examines developing Canadian centres of excellence. The impact of changing HRD demands on a variety of issues is also explored.

There is a need for joint ventures and networks among postsecondary institutions, crown corporations, government departments, non-governmental development agencies, and private-sector companies. This need and innovative ways of increasing the funds available to improve the Canadian response to HRD requests from the Third World are examined.



Le sucre Menace ou défi ?

Évaluation de l'incidence du
développement technologique
dans les industries des
produits sucrés et du sirop
de glucose à haute teneur
en fructose

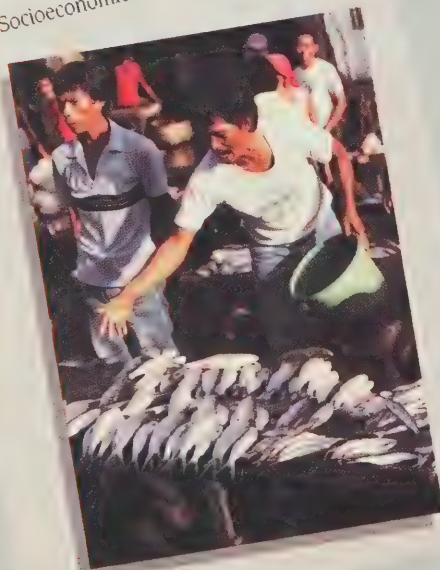
Clive Y. Thomas



Metodología de Investigación en Sistemas de Cultivo en Finca



Small-Scale Fisheries in Asia: Socioeconomic Analysis and Policy



Editor: Theodore Panayotou

In addition to *Reports* magazine, IDRC also publishes scientific monographs, technical reports, and general interest materials on the role of research in international development. A catalogue of current publications is available from the nearest IDRC office (see page 3 for complete addresses).

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REPORTS

VOLUME 18, NUMBER 4, OCTOBER 1990



YEARS
OF DEVELOPMENT
THROUGH RESEARCH

Thirsty Cities



P O B O X 8 5 0 0

IDRC Reports Again

During the course of *Reports* suspension over the past year we were literally inundated with letters from our readers — more than 600 researchers, NGOs, development students, organizations, and government and private-sector companies alike wrote to reconfirm the need for a multidisciplinary view to development that was *Reports*.

To know that we were so well received by those we most wanted to reach and inform is certainly encouraging. We benefited tremendously from the comments and advice. The message from our readers was clear, and we have responded accordingly with the rebirth of a new, reformatted *Reports*. The excerpts that follow are only a very small sampling of our readers' opinions:

Robert Charbonneau, Editor-in-Chief

"Allow us first to thank you for years of useful and enjoyable reading of the publication...we still need to have something like *Reports* which is not too technical, yet adequate for a diversified audience including high school and college students in developing countries who need to get information at their level."

Ruben F. Trinidad, Philippine Social Science Council Inc., Philippines.

"To me, *Reports* was a way of being informed about wider aspects of development work. There are a great number of academic journals but few introduce aspects outside of their specific topics...*Reports* offered a way of broadening both my own and my colleagues knowledge of our work."

Melvin Woodhouse, African Medical and Research Foundation.

"For us in the developing countries, *Reports* contained useful information about development approaches in other countries. Topics of particular interest are the application of science and technology in the process of development."

E.C. Subbarao, Tata Research Development and Design Centre, India.

"To me, *IDRC Reports*' main appeal lay in its interdisciplinary format, as most development issues in the Third World are interrelated. *Reports* has proved to be one of the few publications which presented a holistic viewpoint highly appropriate to understanding and solving problems of poverty."

B.S. Saini, University of Queensland, Australia.

"The information your publication presents gives an overview and a continuity to the appropriate developmental work which we are involved in... learning what projects are being undertaken, which ones work, and what problems are encountered is priceless information that becomes difficult to glean without periodicals like yours."

Michael Manetos, Humboldt State University, USA.

"*IDRC Reports* is a very good magazine in that it is well designed and carries interesting information, especially on agriculture. This information...should reach smaller groups working at the grassroots levels, for example the NGOs, women groups and development workers."

Kabunde Samuel, Kijweka Rural Environmental Education Project, Uganda.

The magazine welcomes letters from its readers. Because of space limitations, letters may be edited or published only in part. Please write to **IDRC Reports**, PO Box 8500, Ottawa, Canada, K1G 3H9.

REPORTS

IDRC Reports is published quarterly by the International Development Research Centre (IDRC) of Canada. Its aim is to keep an international readership informed about the work IDRC supports in developing countries as well as other development issues of interest. The magazine is also available in French as *Le CRDI Explore* and in Spanish as *El CIID Informa*.

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Through support for research, Canada's International Development Research Centre (IDRC) assists developing countries in creating their own long-term solutions to pressing development problems.

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REPORTS

VOLUME 18, NUMBER 4, OCTOBER 1990



The rapid population growth of the Third World in the past 50 years has placed an unprecedented burden on water supplies. Unregulated industrial pollution has only added to the water pinch. The increasing problems of poor water availability and environmental degradation are forcing countries from South America to Africa to Asia to take a hard look at their attitude to water.

THIRSTY CITIES

- 4 **Thirsty Cities**
Dwindling water reserves and poor management of resources are becoming acute barriers to development in the Third World. *Danilo Anton*
- 6 **The Atlantis of the Orient**
In Bangkok, an enormous demand for water has actually made the city sink into the Gulf of Thailand. *Craig Harris*
- 8 **Quest for Water**
Mexico City, the most populated city in the world, is facing serious problems in its water supply. *Steven Hunt*
- 10 **A Taste of Salt**
Once known as the "Green Cape," the area around Dakar has become dried out by saltwater intrusion. *André Potworowski*
- 11 **A Tale of Three Cities**
Sao Paulo, Buenos Aires, and Cochabamba are three very different cities with one thing in common: water pollution.

12, 13 The Black Plague / Networking for Musa

Black Sigatoka disease in banana and plantain has hurt farmers. INIBAP is working to coordinate research. *Stephen Homer and Craig Harris*

14 Stranded at Sea

The rights of seafarers in Southeast Asia is the focus of a study on international shipping and laws of the sea. *Huguette Young*

15 Mapping Their Future

Ethiopia's domestically produced atlas has become a source of national pride. *Jennifer White*



Developments



Technology

16 The Fertility Revolution in China

Results from fertility surveys in China reveal the effects of planning policies. *Carol Vlassoff and Iqbal Shah*

18 At Arms Length

An implanted birth control device has been developed by researchers from all over the world. *Bob Stanley*

20
Rainwater Catchment Systems
A building material called ferrocement has improved the rainwater catchment systems. *Teresita Bagasao*



Profile



Commentary



In Brief

22
Back to Ghana's Future
Kobina Amoah, a researcher from Ghana and winner of an IDRC Pearson Fellowship, talks about his country. *Craig Harris*

24
Beyond Catch Phrases: What Does Sustainable Development Really Mean?
An expert on environmental affairs tackles the thorny issue of sustainable development. *David Brooks*

26
In Brief
27
IDRC at Twenty

THIRSTY CITIES



Water. Next to oxygen it is the most important natural substance keeping us alive.

To many, it seems to be a free and seemingly endless source of life. But it is not endless.

The relentless demand of an increasing global population is placing an incredible strain on existing water resources. This strain has become critical in the larger urban centres of many developing countries. Here, water supplies are not only subject to overuse but contamination as well. Many cities are having problems with both the availability and the quality of water.

A combination of limited resources and poor water management have resulted in widespread pollution, scarcity, and even land subsidence — the actual sinking of cities caused by excessive groundwater extraction.

The larger cities of the developing world show the most visible signs of these problems.

One of the main features of global evolution in the past 50 years has been, and will continue to be, the phenomenal growth of huge urban centres. There are currently as many as 45 cities throughout the Third World with populations nearing, or in excess of, 3 million people.

Eight Third World cities have already exceeded the 10 million mark: Mexico, Sao Paulo, Buenos Aires, Calcutta, Bombay, Cairo, Shanghai, and Seoul. The average growth rates in these cities between 1950 and 1980 was 3.5–4.5% a year. Urban population growth is still very high, placing an extreme burden on water resources.

Population is one of the major causes of water contamination. The water on which cities rely is often polluted by enormous amounts of human waste, sometimes channelled untreated into open bodies of water. Other cities depend on reservoirs that cannot provide enough water for their mushrooming populations forcing people to find alternative, unregulated sources of water.

Urban areas also use large amounts of water for industrial purposes. Once used, these waters suffer significant quality degradation. The polluted waters are then dumped into rivers, lakes, and coastal waters hitting the environment with the double blow of reduced quantity and quality of water. Regrettably, antipollution legislation in developing countries is often vague or nonexistent. Where it does exist, it can be easily circumvented.

In most Third World countries, the economy and environment are caught in a negative cycle. To meet their financial obligations, many countries have concentrated on the production of cheap export goods. This prevalence of industry in urban areas — much of it in the form of multinational companies — is bringing about considerable damage to the environment.

But polluted water can, and in fact has, found its way into the underground reservoirs. Few notice this invisible pollution. But it exists and it is almost impossible to clean up.

Meanwhile, government funding for programs, such as environmental protection, is often unavailable or way down on the priority list. Many national and urban governments do not have the money, or the will, to make a long-term commitment to their natural resources.

The environment is, in essence, being sold along with the cheap exports. There is an unfortunate string of examples.

Coffee-production wastes are ruining the freshwater environment in the Magdalena and Cauca basins in Colombia, in the Tiete basin in Brazil, in the Eldoret region in Kenya, and in Northeastern Tanzania.

Tanning-industry wastes have completely killed the natural fauna and flora of many streams in the province of Buenos Aires, in Southern Uruguay, in India, and in many other leather-producing countries.

Gold-extraction operations (using cyanide or mercury) are destroying the water environment in many developing countries, such as Brazil, Colombia, and Papua New Guinea.

Some heavily industrialized, large urban centres like Sao Paulo, Calcutta, Mexico City, and Cairo have a particularly poor record of environmental protection of their water resources.

Cities, through their expanding populations and industrial exploitation, are damaging or even destroying their life-giving water resources. These urban areas are only beginning to realize that they cannot keep going to the same well.

Where Water Comes From

There are two types of water resources used for urban water supply — surface water (rivers and lakes) and groundwater (underground wells and springs). Surface waters are often the easiest source of water and their use can be very straightforward.

These waters, however, are also easily polluted. In most cases, the small- and medium-size streams of Third World cities have become highly contaminated acting as little more than open sewers. Small lakes located near cities have suffered the same fate.

There are scores of cities that have damaged their neighbouring water bodies. Some examples include the Chao Phraya river in Bangkok, the Hooghly river in Calcutta, the Laguna de Bay in Manila, the Tiete river in Sao Paulo, the Bogota river in Bogota, the Xolotlan lake in Managua, and the Amatitlan lake in Guatemala. The list goes on.

Larger bodies of water, like rivers or lakes, are slightly less vulnerable. They can, however, gradually become polluted and unusable because of increasing demand and a lack of restrictions on usage. Once these



Aboveground pipe carrying drinking water in Mexico: subject to the abuse of the urban environment.

sources of water are polluted, the clean-up task is difficult and expensive. The Nile river downstream of Cairo and the Plate river of Buenos Aires are facing serious and expensive pollution problems.

If current urban growth and environmental degradation trends continue unchecked, it is expected that soon very few, if any, rivers in the developing world will be able to be used for water supply without heavy and expensive treatment procedures.

During the latter half of this century, cities have increasingly used groundwater resources to compensate for the gradual loss of surface water. Many of the 20 larger cities in the developing world pump water from the ground to meet the needs of their populations: Mexico City, Bangkok, Calcutta, Manila, Jakarta, Sao Paulo, Buenos Aires, Beijing, and Shanghai.

Underground water reservoirs are contained in the voids of the sediment and rock underneath the earth's surface. These "aquifers," as they are known to geologists, range from relatively thin and shallow pools to huge volumes hundreds of metres beneath the surface.

This water stored under the ground is often abundant and of high quality. It is also significantly less vulnerable to contamination because it is more or less protected by layers of sediment and rock.

But polluted water can, and in fact has, found its way into the underground reservoirs. Few notice this invisible pollution, but it exists, and it is almost impossible to clean up.

Aquifers, although containing abundant volumes of water, are also finite and cannot accept indefinite extraction beyond their renewal potential.

Unfortunately, not many countries have a clear idea of the renewal potential or the vulnerability of their groundwater resources. Most cities using groundwater — Lima, Beijing, and Manila to name a few — are overpumping their aquifers beyond their renewal possibilities.

Water levels in Third World urban areas have been dropping consistently. In Manila, water levels have decreased during the last two decades by about 4–10 m a year; in Beijing the drop in the city's 40,000 wells has ranged from 1 to 3 m every year. Similar figures have been registered in Mexico City and Lima.

In some coastal cities, overpumping has drawn salty sea water inland, a phenomenon that is called saline intrusion. This is the case in Dakar, Jakarta, Lima, and Manila.

Another negative aspect of overpumping is the dewatering of parts of the aquifer. When water is taken out of the aquifer some moisture also leaves the surrounding layers of sediment. The result is a compaction of the overlying land and a dangerous sinking phenomenon called land subsidence. This has occurred in Mexico City and Bangkok.

Expensive Alternatives

The net effect of this deterioration in both ground and surface water resources is increasing costs in finding alternative water supplies. A basic trend of water resource development is that the most accessible water sources are developed first — and often they are contaminated first. New sources of water are difficult to find and more expensive.

Many cities have actually dropped their standards of water quality, allowing consumption of water that would not normally be considered safe. Although information is scant, there is evidence showing that waterborne sicknesses such as diarrhea, hepatitis, and cholera have become commonplace in many cities.

Other cities have rationed the supply, with water cuts becoming a part of daily life. But this problem is even more pronounced in the poor and slum sections of large cities. It is estimated that about 200 million urban dwellers in the Third World lack the benefits of safe running water. When urban growth and lack of financial resources force governments to reduce their water service, these neighbourhoods usually feel it the most.

Water resource management in developing cities is not getting better. The costs of water supply schemes are booming and many Third World cities are finding it increasingly difficult to afford them.

International loans are drying up because of the growing foreign debt crisis. Infrastructural projects are being postponed or abandoned. Lima will not be able to bring more water from the Amazonian basin — a project estimated at US\$500 million — because of the current deficit situation of Peru. Dakar is still waiting for the construction of the long aqueduct conducting water from the Lac de Guiers to the city site.

In the developing world, where there is a lack of resources and a rapidly expanding population, the current attitude toward water resources can at best be seen as short-sighted. At worst, it is potentially disastrous.

The solution to the problem is twofold, but there are no easy or simple answers. Adequate and responsible water management must be based on a more in-depth knowledge of the surrounding natural and social environment of each particular city. Research and awareness on the availability of water resources (including underground resources) must become a priority in these large cities. In addition, the consequences of overuse and careless disposal of human and industrial waste should be examined in relation to water availability.

Governments and international development agencies must also recognize the importance of water through increased funding.

Recently, there has been a widespread decrease in funds for urban water supply purposes. The World Bank's financing of water projects in Latin America is the most obvious example. The share of the Bank's funding for water projects in relation to total funding has decreased from 7.2% in 1976–80 to 3.9% in 1986–89. A similar trend can be observed in other areas of the developing world and in other financial institutions. This tendency cannot continue if the large cities of the Third World are expected to have safer and sufficient water supplies.

During the last few years there have been some positive signs. Many international lending institutions, including the World Bank and the Inter-American Development Bank, have included environmental sustainability as a key element in their project-development policies. There is increasing awareness of the problems among the people in developing countries. Governments are being pressed to listen, and some measures to improve the situation have been taken.

If this positive trend does not accelerate soon, however, it may be too late for many millions of urban dwellers trapped in this growing environmental catastrophe.

By Danilo Anton, an IDRC regional program officer based in Montevideo, Uruguay.



Going to work in Bangkok.



It happens all the time in the city of Bangkok, but people only notice the symptoms. Gaps in the concrete appear in roads, bridges have bone-jarring

humps at their approaches, and ground floors in hundreds of houses have turned into semibasements. Far beneath the cracks in roads and buildings there is a gradual and almost imperceptible process at work threatening everyone in the city.

Bangkok is sinking — slowly yet inexorably — into the Coastal waters that surround it. Some central areas have sunk by as much as 160 cm in the past half century. The original city limits are now 500 m out at sea.

Annual floods, a constant threat to the city's inhabitants, may only be a warning of worse things to come.

A rapidly growing city of 6 million people, Bangkok suffers from many of the same headaches as other urban centres — traffic congestion, low-cost housing problems, environmental pollution, and waste management problems. But, according to a recent study by Prinya Nulalaya of the Asian Institute of Technology and McGill University Professor Raymond Yong, the coastal metropolis has a much larger problem.

The IDRC-sponsored report, entitled *Land Subsidence and Flooding in Bangkok*, concluded that Bangkok's immense demand for water, coupled



Urban Environments and Water in Latin America With Particular Emphasis on Groundwater
by Danilo Anton, IDRC-MR266e.

THE ATLANTIS OF THE ORIENT

with its vulnerable location, make it the world's slowest quicksand pit — or perhaps more accurately "shrink-sand pit."

Situated at the mouth of the Chao Phraya river, Bangkok is built on layers of soft clay and sandy sediment. The sedimentary layers contain huge amounts of water in natural storage reservoirs, or aquifers.

Thousands of wells in the city pump out more than a million cubic metres of water every day, slowly draining these aquifers. But the pumping also drains some of the moisture from the clay, compressing and shrinking it. This underground process is responsible for the land subsidence at the surface.

Root of the Problem

The enormous water demands of Bangkok's expanding population have placed a strain on the city's water supply, forcing people to drill deeper and deeper for wells. This continuous draining of the underground aquifers is leaving the city lying on a shrinking foundation.

"The root cause of the problem," writes Prinya, "appears to be a direct function of excessive and long-term groundwater withdrawal."

Groundwater pumping began in 1954 when the city's reliance on surface water could no longer meet Bangkok's needs. Originally, aquifers yielded water from as close to the surface as 5 or 6 m. By 1969, Prinya notes, that layer was dry and they were drilling through the underlying clay to 24 m deep. Today, some of the wells for large housing developments must go 200-m deep to be productive.

Prinya estimates that up to 30% of Bangkok's daily water needs are met by groundwater pumping.

This excessive groundwater extraction is not unusual among southeast Asian cities. Indeed, other cities in China, India, and the Philippines face similar problems of land subsidence. But Bangkok's situation is unique.

Situated right on the Gulf of Thailand, the city's surrounding regions are remarkably low-lying and flat. Most areas of Bangkok are only 1.5 m above sea level, leaving the entire area very susceptible to flooding. Floods are occurrences with which the city's residents are all too familiar.

It is one of the world's most flood-prone cities. The region's exceptionally heavy monsoon rains add to the water level of the Chao Phraya river. The river, which winds its way through the city before releasing into the nearby Gulf, often swells because of tides and torrential downpours. When this happens the city goes underwater.

On 8 May 1986 a record downpour of 381 mm fell on the region. Observers said it was the heaviest rainfall in 500 years, flooding the river and leaving hundreds of thousands of motorists and bus commuters stranded in thigh-deep water.

In 1983, a 3-month flood cost the city an estimated 6600 million baht (US\$30 million).

Looking for Answers

Prinya and Yong say these disastrous floods will only get worse if land subsidence continues. This is why IDRC funded a project for the geotechnical researchers to look at the problem and propose solutions.

They spent the first part of their project measuring the amount of land subsidence in Bangkok, using bench-marks placed in the 1930s. They knew there was a problem when they measured the maximum subsiding areas of the city to be greater than 160 cm.

Prinya and Yong also started to look at the composition of the land underneath the city. They found that the aquifers containing the water were blocked by large deposits of clay, "aquitards" in hydrogeological terms. The accelerating well pumping caused a vacuum effect in which the draining of each successive aquifer managed to put pressure on, and draw water from, the aquitards. The result was a shrinking of land.

The solution? Prinya and Yong reasoned that, because natural water resources were rechargeable, outside water should be pumped into the aquifers. The idea is to try to draw clear water from the rivers upstream, above the city, and drive it through large pipes into the underground sand layers. They want to balance what is taken out with what is put back in.

This balance will hopefully mean no more suction is created in the sand and no more water drained out of the clay. Water could still be pumped from the reservoirs without shrinking the clay, thereby keeping the land from sinking any lower.

Although the idea may seem fairly rudimentary, the reality of the situation is far from simple. One problem is the expense of the process — the researchers have only vague estimates about the cost. More research would also have to go into the make-up of the underground aquifers, whether they can simply be recharged with large doses of river water.

All of this makes for a difficult but, according to Prinya and Yong, extremely necessary plan of action.

The two engineers realize they cannot lift Bangkok back to its previous level. Land subsidence is an irrevocable process. They simply want to slow and hopefully halt the pace in which the ground is sinking — before the city's residents become painfully aware of more than just the symptoms.

By Craig Harris.



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Shopkeepers coping in spite of more frequent and serious flooding. Bangkok sinks lower every year.

QUEST FOR WATER



When the Spanish explorer Hernan Cortés first arrived in what is now Mexico City he viewed the lush Aztec capital of Tenochtitlan. In 1519, the city was surrounded by a 500 square km lake with water flowing generously from underground springs.

A lot has changed since then. In terms of water, many say it has been a change for the worse.

Over the centuries, the lake has receded with sections of the city now located on what used to be its bottom. The burgeoning population of this urban giant, currently 21 million people, has exhausted the springs, forcing Mexico to rely completely on its aquifers — underground water reservoirs. Constant pumping has resulted in consistently dropping water levels. The city is showing signs of drying up.

Mexico's aquifers, the traditional natural source of drinking water, can no longer keep pace with the demands of a growing population. The imminent effects of shortages in water, already felt in some areas, hang like a dust cloud over the city.

"If we go the way we are now living, in 10 years the problem will be critical," says Jaime Durazo of the Institute of Geophysics at the National Autonomous University of Mexico.

Durazo is part of a team of Mexican and Canadian researchers trying to measure the quantity and quality of Mexico City's underground water reservoirs.

The valley of Mexico is known to water experts as an "isolated hydrological system." Water only leaves or enters the area through rain or evaporation.

Although other cities can rely on rivers or lakes, Mexico depends almost exclusively on its once-vast underground aquifers for potable water. The aquifers are replenished by rainfall seeping underground, but not nearly at the same rate water is pumped out. For Durazo, that's the heart of the matter.

Finite Water Supply

"The fundamental issue is that we are in a pot — the supply of water is finite," he says. "The amount of water that goes into the aquifers (from rainfall) is around 20 cubic m per second. We are taking out three times that amount, slowly draining our resource."

The major reason for this excessive groundwater extraction is population growth. The demand for water is directly tied to a population expected to grow to almost 30 million by the end of the century.

But consumption of water is not limited to individuals: industries also have a great thirst. Almost 60% of the nation's industry is concentrated in the valley of Mexico, the third largest region in all of Latin America.

The heavy demands placed on Mexico's fragile water system and the weak environmental control system for the disposal of industrial and domestic waste are beginning to make

themselves felt in both shortages of water and contamination. Clearly, the Mexican aquifers can only meet the city's daily water needs — more than 4 million cubic m — for so long. Pollution is making some groundwater unfit for consumption.

There is no way to measure how many industrial by-products or how much of the 13 million kg of sewage the city produces each day will eventually permeate into the groundwater. But poor water management has led to some ominous developments.

A number of the pumping wells used for urban water supply are located next to the Chalco Canal — one of the main passageways for wastewater leaving the city. With the wells being so close there is a strong risk of contamination.

Indeed, some wells in the suburb of Xochimilco have been forced to close because of a high presence of nitrate in the water. The reason was industrial pollution.

Mexico's aquifers are protected by thick strands of clay, long thought to act as impenetrable barriers for the water reservoirs. Recent studies have shown that the aquifers may not be so well-protected, says Durazo. "One of the main contributions of our research has been to prove that the clays are not impermeable. They may be impermeable in terms of a local scale, but on a large scale they are very well fractured."

The implication is that sewage and industrial pollution can reach the vulnerable aquifers, rendering the water unsafe for human use.

Sinking City

Land subsidence is another of Mexico's water dilemmas. The increased demand for water has forced people to drill deeper and deeper for wells. Researchers have found that this leads to a draining of the water contained in the underground layers of clay, causing the land to shrink. In 1959, when most of the wells were located in the heart of the city, Mexico was sinking at a rate of 40 cm a year.



Garbage strewn outside a water pipe in the suburb of Nezahualpille, Mexico City.



Industrial waste is dumped straight into the Chalco Canal, a major sewage passage.

The process has slowed somewhat with the deeper wells moved to the outskirts of the city, but the effects are still visible. Mexico's famous opera house, El Palacio de Bellas Artes, has come to rest at a slight angle, as has the city's most recognizable monument, the Cathedral of Mexico. Worse, many of the underground sewers and pipes have suffered considerable damage from the pressure of land subsidence.

The research project, begun in 1985, was organized to analyze and suggest solutions for many of these water problems. But it has only started to reveal how much or what kind of water lies underneath the city. "We don't know if there are 5 or 125 years of water, but we do know there is no cheap alternative," says Robert Farvolden, a professor with the University of Waterloo's Centre for Groundwater Research and one of the researchers working on the project.

Alternatives are indeed few and far between. The Mexican Valley is 2000 – 2500 m above sea level — much higher than most other water basins in the country. Any importing of water will require that it be pumped uphill at great expense, estimated in the billions of dollars.

For now, Farvolden says, researchers have to stick to the underground aquifers. "What we must do is show how this system can be exploited to the maximum to allow the greatest use of the resource and to give us the maximum amount of time to search for an alternative."

Striking it Rich

Results from recent studies have bought the researchers more time. They found that the large water-bearing strata under Mexico City are much thicker than previously thought. Wells are tapping into the lower levels, which may be exploited down to 500 m, perhaps further.

But this discovery is not a complete solution to Mexico's water problems. The water levels of the aquifers will continue to drop because the amount of water taken out is greater than the recharge. Researchers realize that the aquifers cannot last forever and that the problem of land subsidence may continue with even deeper drilling.

They want to be able to know exactly how the aquifers work and the limits to which people can pump before causing irreparable damage. They need a more precise model.

"Planners must have a good idea of the future supply of water," says Dr Ismael Herrera of the Geophysics Department at Mexico's National Autonomous University. He is also the head of the research project. "It's very important to make a precise estimate, through a model, of how much water can be taken out without producing permanent damage."

To gain a better understanding of Mexico's aquifer system, Herrera and his team have been using data from both new and old wells. This information has been developed into a mathematical model for predicting the behaviour of the aquifer and the future availability of water for urban and industrial use.

Herrera and his research team anticipate that the model will be used by Mexican officials and policy planners as a guideline for water pumping and usage.

Mexico City knows it can never go back to its previously water-abundant state. But researchers hope they can monitor the amount of water left, so the receding supply will not leave residents of the city high and dry.

By Steven Hunt.



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A TASTE OF SALT



Dakar, the bustling capital of Senegal situated on the western-most tip of continental Africa, is running out of fresh water. Part of the problem is its location — it sits on a cape that juts out into the Atlantic Ocean. Known originally as "Cap Vert," or "Green Cape," the area round Dakar has gradually become dry and desolate.

As fresh water is rapidly pumped from local wells, the natural underground veins of water-bearing sand and rocks are slowly being contaminated by saltwater intruding from the neighbouring ocean.

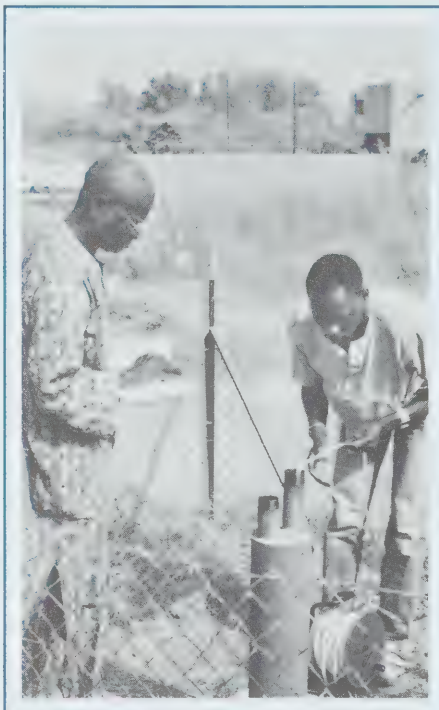
The 1.5 million people of Dakar get 80% of their drinking water from these aquifers. The rest is drawn and transported from Lake Guiers, some 300 km away — at great expense.

Water consumption has increased with population growth and industrialization in Dakar, and the severe Sahelian drought of the early 1980s has slowed the replenishment of the aquifers. Researchers predict that if the aquifers continue to be tapped at the current rate, Dakar's wells will be entirely contaminated with salt water in about 50 years.

Two Senegalese geologists, professors Cheikh B. Gaye and Abdoulaye Faye of Dakar's Cheikh Anta Diop University, decided to find out more about underground water salinization and what could be done to halt or even reverse it. They were joined in the IDRC-funded project by Pierre Gelinat and his research associates from the Université de Laval in Canada.

The scientists studied the underground structure of the five aquifers in Dakar and along the Cap Vert peninsula monitoring some 100 wells.

Over a 2-year period, the Senegalese geologists and their Canadian colleagues have used these test wells to monitor critical factors such as water levels, electrical conductivity (an indication of salt content), temperature, acidity, and the



Each month, researchers evaluate the level and quality of water in the aquifers of the Dakar area.

concentration of chemical ions. All data were processed by computer, relying strongly on the expertise of the Canadian scientists. Through mathematical simulations they determined how fast the sea water was moving in.

Inland 800 metres

They came to some startling conclusions. Already, salt water pollution has penetrated inland some 800 m — to the head of the peninsula in Dakar. Their first trial calculations indicate that the advancing saltwater is contaminating the aquifers at an average rate of 40m a year, depending on the amount of rainfall and the amount of water pumped out of wells.

Given the difficulty of reducing water consumption, there are few options for stopping or reversing the process. One measure is to close down a contaminated well for a few days, until rainwater seepages restore it to its former water quality. But such a closure is felt immediately in the distribution system: water pressure

drops or the supply is actually cut for a few hours or even days in parts of the city. For this approach to work, scientists believe that wells should be closed for months or years. The effect on Dakar would be staggering.

Irreversible Contamination

In the long run, the process of groundwater salinization and contamination could be irreversible.

Other options are to reduce the rates of pumping or to skim the top freshwater layer of the aquifers with several shallow wells — a practice followed in other countries.

Another approach is to increase the water supply. Senegal plans to build a canal (Canal du Cayor) that will bring additional fresh water from Lake Guiers to the city. But the canal will not be completed until 1995.

The Senegalese geologists are looking at ways of improving the management of the aquifers by adjusting pumping rates at selected well sites, without reducing the total output. This would allow some of the fresh water in the aquifer to flow toward the sea and, in effect, to push salt water back.

In all of these options, the new computer model — designed by the Canadian researchers to analyze water salinization — will prove a valuable instrument to SONEES (Société Nationale d'Exploitation des Eaux du Sénégal). The state-owned body, responsible for the distribution of water, will look seriously at the proposals of the Dakar and Canadian researchers.

By André Potworowski, a consultant in management of technology in Ottawa.



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A T A L E O F T H R E E C I T I E S

STRAINING THE LIMITS

Sao Paulo is one of the fastest growing cities in the world. If present trends continue, the Greater Sao Paulo region will contain about 27 million people by the year 2000, and 37 million by 2010.

Combined with a poor water management system, this surge in population could spell disaster for Sao Paulo — or dehydration.

Sao Paulo's once steady supply of water is gradually drying up or being contaminated. The Pinheiro and Tiete rivers, once major sources of water for the Brazilian economic capital, have now become sewage dumps.

The complex network of reservoirs from the rivers' tributaries are facing high contamination levels. With this main source of water becoming unfit for human consumption, Sao Paulo is facing some tough decisions about its future.

Groundwater is scarce in the region. Unfortunately, the city lies on the crystalline Brazilian shield with few underground water reservoirs.

Perhaps the biggest problem — and potential solution — lies in the city's mismanagement of wastewater. Unmonitored dumping of raw sewage into the rivers of Sao Paulo has created dangerous contamination levels.

Since 1985, IDRC has been sponsoring an ongoing project aimed at preventing the widespread degradation of Sao Paulo's water supply. Researchers from both Canada and Brazil are measuring the levels of contamination in the city's water resources and trying to suggest ways of improving water quality and distribution.



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BACKING INTO A CORNER

Uncontrolled sewage and waste-water, environmental degradation and scarce water resources also confront Argentina's capital of Buenos Aires. But there is another problem.

The city's groundwater reserves, which account for almost 40% of the drinking water, are at risk of contamination by saline intrusion — the infiltration of salt water. As a result of unrestricted underground pumping, the saline water has reached one of the region's largest reservoirs, the Puelche aquifer. A number of wells have been forced to close.

Poor water management has only heightened the problem. The outflow of large sewers and wastewater goes largely unchecked into the River Plate, another major source of water for the region.

An IDRC-sponsored project began to examine the threat of contamination and mismanagement to Buenos Aires' groundwater in 1988. Scientists from Argentina and Canada are currently trying to find a successful way of meeting the city's demand without damaging its fragile resources.



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AN ILLUSION OF BEAUTY

The Bolivian city of Cochabamba lies in a beautiful and scenic valley. But beneath this serene setting are many of the same water problems plaguing other South American countries.

The river Rocha, which runs through the city, is heavily contaminated: it cannot be used for any water supply or irrigation purpose without treatment. Lakes on the outside of the city supply much of the city's water, but there is little protection against the risk of contamination from a growing population.

About 60% of Cochabamba's population depends on groundwater supplies from wells. Drilling of these wells continues at a rapid pace, with no legal tool to control or prevent excessive groundwater extraction. Recharge areas, designed to restore water in the underground reservoirs, lie unprotected and vulnerable to the contamination of an uncontrolled waste-disposal system.

To worsen this vulnerability, Cochabamba suffers periodic and acute droughts. These dry periods make use of surface water practically impossible forcing people to rely solely on groundwater. This places an extreme burden on Cochabamba's underground reservoirs.

In 1988, IDRC began funding a project studying the groundwater system of the Cochabamban valley. Researchers are interested in formulating a more sustainable model for groundwater extraction.



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THE BLACK PLAGUE

For 12 years, Carl Walfall Johnson struggled to make a living from his 14 hectares of plantain near the town of Guacimo in the Atlantic lowland of Costa Rica.

By 1986, his plantain production had been reduced from a healthy standard of 1500 bunches every 2 weeks to only 800. On the verge of bankruptcy, he sold his plantation and went to work for a large banana company.

His flight from plantain farming, like that of hundreds of other small-scale banana and plantain growers was caused by Black Sigatoka (*Mycosphaerella fijiensis*).

The disease was first detected in Central America in the country of Honduras in 1972. Since then, it has spread rapidly throughout Central America, Mexico, and northern South America. Moving southward, Black Sigatoka has already hit Ecuador and is threatening some of the most important plantain-producing areas in Venezuela.

The disease spreads spores that infect and rapidly destroy the leaves of both banana and plantain. As the leaves turn brown and plant energy reserves are depleted, fruit production is greatly reduced.

Black Sigatoka's effect has been serious enough to claim thousands of tonnes of banana and plantain in Central America, endangering the livelihood of subsistence growers. In a 4-year span in the 1980s, Costa Rica experienced an 80% drop in plantain exports — from 26,000 to 5000 tonnes.

These losses are particularly tough on small-scale farmers who often rely on banana and plantain as food crops. It is estimated that more than 80% of the worldwide production of these fruits are consumed by farm families or sold in local markets.

The only effective protection against Black Sigatoka is aerial spraying of fungicide — and it is too expensive for small-scale growers like Johnson. Most farmers have to spend at least US\$300–400 to protect their fruit.

Researchers at CATIE (Centro Agronómico Tropical de Investigación y Enseñanza) in Costa Rica are working with IDRC on several fronts to combat the disease.

Scientists initially focused their efforts on developing resistant strains of plantain, a species with little genetic variability in Central America.

Ironically, there already exists a native plantain resistant to Black Sigatoka. The catch — its fruit, despite superior flavour, is short and round. It is unacceptable to the Central American consumer, accustomed to traditional, banana-shaped plantain.

Dr Ludwig Muller, a plant physiologist at CATIE for several years, exposed large numbers of plantain tissues to chemical mutation enhancers in the hopes of finding a strain that produces both quality fruit and yet remains resistant to Black Sigatoka.

After producing more than 15,000 plants using this technique, only two strains have shown partial resistance to the disease. More mutation tests, however, are being applied.

Dr Ramiro Jaramillo, the regional director of the International Network for the Improvement of Banana and Plantain (INIBAP), says "research efforts are now concentrating on the control, not cure, of the disease." He notes several new aspects in the fight against Black Sigatoka.

Farmers are using new fungicides, more effective in protecting banana and plantain plants. The new chemicals, called sterol inhibitors, have shown some signs of success in controlling the disease.

Researchers have also developed an "early warning disease survey" to monitor the spread of Black Sigatoka. Through epidemiological tests, scientists can know where the disease is moving.

The techniques of fungicide spraying have also improved. Low-volume application techniques with good coverage have decreased the range of exposed plants.

Jaramillo says farmers have been recommended to use undercanopy irrigation instead of the overhead form to reduce the incidence and severity of the disease.

Despite these measures, Black Sigatoka spores have continued to spread rapidly throughout many regions in South and Central America.

The tiny country of Costa Rica may have been hit the hardest. Until resistant strains are developed here — or Costa Ricans accept an unorthodox shape of fruit — plantain will continue to disappear.



Fungicide spraying against Black Sigatoka — affordable mostly to large companies.

Plantain acreage can be replaced by banana, but this will require large doses of chemical spraying to protect the fruit from Black Sigatoka.

Large banana companies, existing primarily for exporting purposes, seem to be a future trend for Costa Rica, perhaps for much of South and Central America.

But there is no need to tell Carl Walfall Johnson about that. He already knows.

By Stephen Homer.



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NETWORKING FOR MUSA

In developing countries, bananas are more than just a pleasant snack. They are the major fruit export from tropical regions.

Farmers, mostly from developing countries, produce about 62 million tonnes of the fruit each year with an estimated market value of US\$10 million. Plantain, a fruit from the same *Musa* species as banana, is a staple food for consumption in South America and Africa.

Whether in Asia, Africa, or South America, the presence of the broad-leafed plantain and banana

The nutritional importance of banana and plantain can also not be overstated. They are a rich source of carbohydrates, as well as potassium, calcium, and vitamin C. It has been said that humans can live quite well on a diet of milk and bananas or plantains. For people living in poverty in developing countries this is good news.

It was concern over the fungal disease, Black Sigatoka, that led to the founding of INIBAP. The rapid spread of this devastating disease to Africa and Central and South America has resulted in huge fruit losses.

The alarming lack of organized research into banana and plantain confronted many who were trying to find out more about the disease. Even with other older diseases, like bunchy top and Moko disease, there was little concentrated research information.

INIBAP stepped into this void of information to protect the most vulnerable part of the plantain and banana business — the small-scale farmer.

Although its headquarters is in Montpellier, France, the emphasis in INIBAP is on networking. Its main goal is to coordinate the different areas of research into banana and plantain around the world. It publicizes research results from various projects around the world hoping to connect distant areas with recent developments on the *Musa* species.

INIBAP's small administrative and scientific centre in France is only one aspect of the organization. Most of the actual work and testing is done through regional networks.

The organization has four regional networks — one for Eastern Africa in Burundi, one for West and Central Africa in Nigeria, one for Latin America and the Caribbean in Costa Rica, and one for Southeast Asia and the Pacific in the Philippines.

The constant search for strains of the fruit resistant to disease is one of the big tasks of the banana network.

Countless local varieties exist all over the world and it is up to INIBAP to test their resistance and exchange information on hopeful strains.

Recently, INIBAP set up an international *Musa*-testing program (IMTP), aimed at evaluating various germplasm. A major goal of the program is to bring together worldwide strains of *Musa* germplasm in the hope of finding one resistant to Black Sigatoka disease.

INIBAP is involved with research on a more direct level too; developing and improving "in vitro," or test-tube, methods of reproducing the fruit. They are trying to achieve the most productive, healthiest strain possible. INIBAP also experiments with breeding new, healthier varieties of banana.

Funding training for researchers from developing countries remains an important part of the group's mandate.

The network hopes that its research projects will target the small-scale farmers. These farmers often eat their own produce to survive or sell it at local markets. Because of the small-scale nature of their farming, they cannot afford to do research or spray pesticides.

Where bananas are grown on large plantations for export, knowledge of production is excellent. Industrial research programs have supported the banana industry for many years.

For crops grown in the back yard, however, little research has been done — until now. One of the main goals of INIBAP is to fund and conduct research into the much-ignored area of plantain.

Through the partial funding of INIBAP, IDRC is hoping to get more research results across to help the small-scale farmers. There is no need to convince them that plantain and banana are a serious business.

By Craig Harris.



Researchers around the world are working together to control the disease.

plants are, thankfully, ubiquitous.

To recognize the importance of the fruit for developing countries, IDRC helped set up the International Network for the Improvement of Banana and Plantain (INIBAP).

The organization has been growing steadily since its formation in 1984. INIBAP receives its funding from IDRC and the governments of Belgium and France.

Although it is estimated that people in developed countries eat no more than 30 g of banana per week, citizens in some African countries consume up to one-half a kilogram each day. Indeed, millions of people living around the great lakes of eastern Africa eat about 250 g a year.



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STRANDED AT SEA



Left, Asian seafarers provide the industry at large with its main source of labour but are often an unprotected commodity.

Above, the port of Bangkok. The booming economy of Southeast Asian countries contributes to the already heavy sea-going traffic.

For many Asian seafarers, life at sea today is a lot less attractive than it used to be. With modern-day cargo ships operating in a competitive world market, the seafaring sense of adventure is gone. Pay and conditions, however, have remained about the same.

Seafarers are one of the main victims of labour exploitation, according to a recent study *Seafarers in the ASEAN Region*.

Many shipping companies do not obey labour laws and governments are not interested in enforcing them, the study shows. Shore-based and shipping jobs for unskilled seamen are limited. If they do get jobs, many of these Asian sailors' rights are not protected at sea.

"It looks like seafarers are used and abused by whomever they want," says Dr Mary Brooks, the editor of the study. "They have no legal rights once they leave their home ports."

Brooks, a professor of international business at Dalhousie University in Canada, has studied the world shipping industry and its impact on seafarers in Thailand, Singapore, Indonesia, Malaysia, and the Philippines as part of a 2-year study funded by IDRC.

Coordinated by the Institute of Southeast Asian Studies and the Dalhousie Ocean Studies Program in Canada, the study evolved out of a larger project on ocean management called SEAPOL (Southeast Asian Project on the Law of the Sea).

To Brooks, it has some wide-ranging implications for Southeast Asia, one of the busiest shipping regions of the world and a traditional source of low-paid seafarers.

Long-Term Neglect

Under the leadership of Dr Chia Lin Sien of the National University of Singapore, experts examined labour laws and shipping policies affecting seafarers in Southeast Asia. Although conditions have improved slightly over the years, the study shows the overall situation of ASEAN seamen is bleak.

Jobs are scarce, labour laws are weak, and training facilities are outdated. The Philippines and Indonesia have more workers than jobs and they are facing stiff competition from even lower paid seamen from South Korea, Sri Lanka, and China.

The study found that the record of ASEAN countries adopting international labour conventions "can hardly be called impressive."

Singapore, "the most progressive state in the region with regard to accepting International Labour Organization (ILO) conventions, has adopted only 6 of the 34 conventions in the field. Moreover, it has not adopted any of the conventions produced since 1932. The record of the other ASEAN states is less enviable," the study reveals. Indonesia, like many other countries, has accepted only one convention.

A critical piece of legislation, the 1978 ILO Convention 147, which sets standards for the minimum age of employment, medical examinations, wages, food, and accommodation, has not been adopted by a single ASEAN country.

Part of the problem for seafarers in the area is that there are no standard wage rates. Sailors are often left to the mercy of shipping companies who "have tended to go to the source with the cheapest crew," the study shows.

Malaysia has no legislation on wage levels and Thai seafarers are not in a strong bargaining position because they have no union. Indonesian seamen only have a minimum of rights protected by labour contracts.

Only Singapore and the Philippines maintain wage guidelines more or less in line with international conventions.

Future of Seafarers in Jeopardy

Today's world shipping industry is a sophisticated and complex operation requiring highly trained seafarers to operate state-of-the-art equipment.

Brooks warns that the future of new generations of seamen could be in jeopardy if their skills are not upgraded to meet the changing demands of the shipping industry.

A major complaint from shipping companies hiring seafarers in Southeast Asia is that "recruits represent the bottom of the barrel among school drop-outs," says Dr Chia.

As ships become increasingly automated, "it may be difficult for seamen in Southeast Asia to compete with seamen trained in the West, where government subsidization can reach extremely high levels," the study reveals.

One solution, Brooks says, is for countries such as the Philippines and Singapore to "look at the high end of the market: training them fewer but training them well."

All ASEAN countries, except perhaps Singapore, need specialized training in computer guidance and satellite communications.

One of the frightening aspects of this study, to Brooks, is that it only "touches the tip of the iceberg" regarding the rights of ASEAN seafarers. She hopes, however, that some of the study's recommendations will act as a guide for future government policy.

"The future doesn't look good," Brooks warns. "The legislation affecting seafarers in Southeast Asia is in very bad shape."

By Huguette Young.

MAPPING THEIR FUTURE

When it comes to atlases, few developing countries have the technology — or money — to make their own. But Ethiopia's new atlas has become a source of national pride. It is the first domestically produced information guide about Ethiopia and its people. Before the release of the National Atlas of Ethiopia, a European text was the only way one could find out more about the African country.

With funding from IDRC and the Ethiopian government, the Ethiopian Mapping Authority (EMA) published the 160-page colour atlas in 1989 pointing the way for other developing countries.

The atlas is more than simply a geographical map. It deals with land use, population distribution, education, food crop production, history, and commerce — all educational tools vital to a country's sovereignty and prosperity. "This atlas is a contribution towards the ongoing efforts to establish a fully fledged socio-economic and natural resource database for the country", writes Asfaw Fanta, EMA's general manager in the foreword to the atlas.

This reliable, first-hand information is also essential for development planning, allowing researchers to monitor the environment and prevent its deterioration.

The atlas embodies various aspects of Ethiopian life, from geography to culture and history. The cover design reflects this diverse approach — a depiction of two images of the Ethiopian countryside, a rural village, and a hilly farming area. The back cover shows another side of Ethiopian life — an illustration from an ancient Coptic Orthodox church.

The 38 X 38 cm atlas, written in English, is being distributed to national and foreign organizations, libraries, corporations, and individuals at a cost of US\$126.

The EMA produced a preliminary black-and-white version of the atlas in 1981, but high demand (all 600 copies were sold out within months) pushed the agency to create a multicolour edition.

Production of the atlas is the most visible result of 35 years work by EMA staff. As a government agency, the EMA employs more than 300 people, most of whom are involved in professional and technical mapping activities. With work on the atlas completed, it will continue ground surveying, aerial photography, cartography, and providing information to agriculture, water resources, forestry, and other development sectors.

IDRC became involved with production of the atlas in 1983. Geoffrey Mathews, a cartographer from the University of Toronto, went to Ethiopia as an IDRC representative. He helped with maps and research looking at information from international records, government departments, EMA surveying studies, and universities.

The Ethiopian government hopes the valuable information in the atlas will help the country toward its goal of self-sufficient food production. The difficulties in gathering material, however, also reveal the need for improved data-collection and publication methods in Ethiopia.

By Jennifer White.



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"Seafarers in the ASEAN Region"
Edited by Mary Brooks
Published by Institute of Southeast Asian Studies, 1989



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THE FERTILITY REVOLUTION IN CHINA



In the early 1970s, China had one of the highest population growth rates in the world. Its population, dangerously nearing the billion mark, made up one-fifth of the total world population. Concerned, the Chinese government set out to introduce a series of family planning policies.

What has happened since, as many demographers have observed, represents one of the most rapid "fertility transitions" in human history.

But the real social effects of this remarkable turnaround are only now beginning to emerge. The results of the second phase of the In-Depth Fertility Surveys were released in China earlier this year. The results of the first phase were made public in 1988.

China's State Statistical Bureau conducted the surveys with the help of the International Statistical Institute in the Hague and the governments of Norway, Finland, and Denmark.

The study involved interviews with married women aged 15-49 in various parts of China. It documented some dramatic changes.

At the time the Chinese government announced its first family planning program, women in China had an average of nearly six children. The "later, longer, fewer" campaign of 1972, which emphasized later ages for marriage and childbearing, longer intervals between births, and smaller families, showed positive signs of

getting the birth control message across. By the time the one-child-per-family policy was announced in 1979, fertility had fallen to 2.7 children per woman.

The one-child policy has led to even further reductions. Urban areas such as Beijing and Shanghai have essentially conformed to the policy, while rural areas have reached an average of about two children per family.

The fertility-reduction program has been successful. Indeed, it may have gone farther than some wanted.

Not All Positive

Because China has now attained fertility levels impressively lower than most other developing countries, researchers are beginning to look at how Chinese society has adapted to the family planning programs. Not all of the developments have been positive.

Dr Zeng Yi, Deputy Director of the Institute of Population Research at the Beijing University, says the discrepancy in statistics between rural and urban settings could be a major problem.

He predicts that, in the future, only 8% of rural women will comply with the one-child policy, with the average settling at 2.5 children per woman. But 61% of urban women will have only one child.

This, in the long run, could mean a shortage of young people in cities to care for their elderly parents. "Serious labour shortages and a significant health care burden imposed by aging urban populations will plague Chinese cities in the next century unless policies are introduced to mediate these effects," Zeng Yi says.

These proper policies, he says, should include the encouragement of rural youths to migrate to towns and cities and greater consistency in family planning in rural and urban areas. Stricter enforcement of birth control, for instance, may be needed in the countryside, whereas some relaxation of the one-child policy could be considered in urban areas.

The birth control programs have also been unable to change the ingrained preference for a son among married couples. Despite government efforts, increased education, and modernization, more than 50% of respondents in the fertility surveys wanted a son as their first child, compared to only 5% who wanted a daughter. The others did not express a preference.

Often, those couples whose first child was a male signed the one-child certificate, whereas those whose first offspring was female went on to have other children in the hope of having a boy.

Blend of Old and New

Despite the potential problems of urban underpopulation and the inherent favouritism of son preference, the Chinese have managed to fuse successfully the modern notion of family planning with tradition. The results of the In-depth Fertility Surveys showed this fusion of attitudes and behaviour relating to fertility and family planning.

One of the main topics the study concentrated on was the age of Chinese couples at marriage and co-residence. An important component of China's birth control program has been the encouragement of late marriage and the postponement of childbearing. The legal age of marriage was raised from 18 to 20 in 1980 but the officially recommended age has been higher — 23 for rural women and 25 for urban women.

Since 1982, marriage age has averaged well over 20-years-old in all of China's provinces. Indeed, average marriage ages have been similar to those of developed countries for nearly two decades.

Many traditional marriage customs, however, remain largely intact. The tendency, for instance, to have both an official state marriage and a traditional family ceremony still exists.

Co-residence with parents after marriage is also still common in China; between 70 and 85% of all couples identified in the surveys lived with their parents for some time after marriage. Despite the later ages of marriage, there has actually been a slight increase in the custom of co-residence with parents.

Marriage partners and freedom of choice were also investigated by the fertility surveys.

Traditionally, the selection of appropriate marital partners was the domain of Chinese parents through arranged marriages. The Marriage Laws, introduced in 1950 and revised in 1980, outlawed many ancient practices, including early marriage, arranged marriage, dowry, and brideprice.

Although some of these traditions still persist, the laws have provided support to those who want more control over marriage decisions.

The surveys indicate that parental involvement in marriage has slowly diminished, with half of the women in Beijing stating their parents were not involved. But parents are not completely out of the picture.

"What appears to be happening in marriage decisions in China is that, although parents today do not have absolute control over their children's marriages like in earlier generations, young people are not necessarily shutting their parents out of the process either," says Nancy Riley and Zhen Jian, two researchers involved in the fertility survey.

At a time when the independence of children and young adults has increased, there has ironically been a stressed interdependence among family members.

This development in China is divergent from classical theories of modernization that hold that, as societies modernize, parents and children become increasingly detached from one another. Somehow, China has managed to balance increasing child independence with an emphasis on joint decision-making in the family.

Another area of the study focused on breastfeeding. In many parts of the world, declining fertility rates and the emancipation of women from traditional household roles have eroded customary practices of prolonged breastfeeding. In these countries mothers have abandoned breastfeeding completely or weaned newborns quicker because of the availability of breast milk substitutes and work opportunities outside the home.

Chinese mothers have not apparently adopted this practice. Instead, they still breast-feed for periods lasting more than 2 years, especially in rural areas. Paradoxically, the fertility decline has in fact produced a recent increase in feeding durations. Chinese women tend to breast-feed the last child longer than the earlier offspring.

The one-child policy has had the unexpected effect of actually extending the traditional periods of feeding.

IDRC participated in the fertility surveys through the training of Chinese researchers. Members of IDRC taught specific skills for each stage of the project — sampling, survey practice, data processing, data analysis, and report writing. This training reduced Chinese dependence on foreign expertise.

The In-Depth Fertility Surveys concerned a subject of the highest national importance in China. Previous population information came mainly from the 1982 census and two sample surveys that provided only limited information.

The in-depth surveys were unique in gathering a wealth of data on the human factors behind demographic trends and public policies.

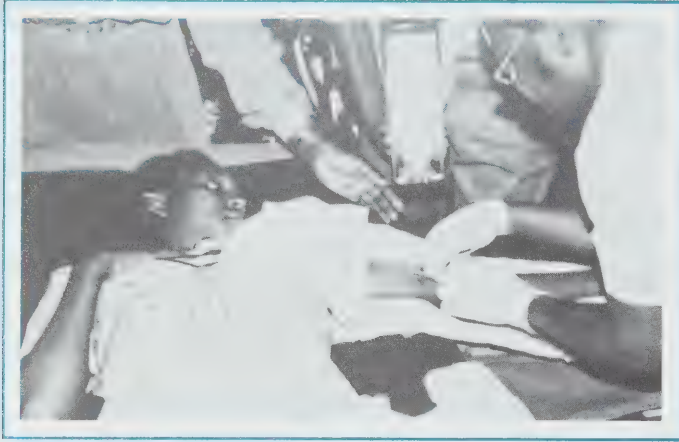
They revealed the attitudes of the people toward the one-child policy, family planning behaviour, and fertility preferences. As such, these tools of information can be considered by policymakers to devise strategies appropriate for sustainable development in China.

By Drs Carol Vlassoff and Iqbal Shah, scientists working with the World Health Organization.



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AT ARMS LENGTH



A health worker inserting a NORPLANT capsule at a Kenyan clinic.



In a small rural clinic in Kenya a doctor performs a simple operation on his first patient of the day, a woman of about 30. First, he applies a local anaesthetic to her upper arm; then, using a specially designed instrument, he carefully inserts six thin rubber capsules about the size of matchsticks beneath the skin of her arm. In 10 minutes the procedure is over and the woman is ready to leave. By nightfall the capsules have begun to work — the woman will be protected against pregnancy for the next 5 years.

What the doctor inserted in the woman's arm were NORPLANT capsules, the first contraceptive implants to become available for general use. NORPLANT has been approved in 15 countries and is currently being reviewed by the Food and Drug Administration (FDA) in the United States. It is estimated that close to half a million women are using, or have used, the implant worldwide, and the numbers are increasing rapidly.

The contraceptive part of NORPLANT is not new. The thin rubber capsules contain small doses of a synthetic hormone called levonorgestrel, a substance used in oral contraceptives for years.

What is new is the method by which the contraceptive is delivered: a continuous release of controlled amounts of hormone into the woman's body for a period of up to 5 years.

This small but constant release of hormones from capsules provides full-time protection against pregnancy.

The development of NORPLANT is a fascinating and surprising story; fascinating, because it demonstrates how complex, costly, and fraught with hazards the process of developing a contraceptive can be. It is surprising because, despite the cost of over \$20 million and 25 years of research, NORPLANT was not developed by one of the multinational pharmaceutical giants, but by the Population Council, an international nonprofit organization based in New York. The process is also surprising because many of those responsible for developing the implant didn't believe it would be accepted by women.

Wayne Bardin, a vice-president of the Population Council, became involved with the project 10 years after it began. "There was a great deal of opposition to implants from population experts who were convinced that women would never accept the methods," he said. "Even I had some doubts." But the experts were wrong.

From the very beginning, the Council never had difficulty attracting volunteers to test the new contraceptive. Indeed, when the implants were removed at the end of the trials, many women wanted new ones inserted again.

As is often the case in research and development, the creation of NORPLANT required a small measure of chance. It is just possible, for example, that if the Population Council's Dr Sheldon Segal had not had lunch one day in 1965 with a representative of the Dow Corning Corporation, the implant might never have been developed. Over lunch the conversation turned to Silastic, a polymerized silicone rubber material used by Dow Corning in artificial heart valves and other medical implant devices.

To Segal, Silastic material suggested another possibility — a contraceptive implant. If dyes and other liquids slowly dissolved through the Silastic implant, hormones, he reasoned, could also slowly release from the capsules into the body. He began to test his idea that same day in his laboratory on female rats. The concept was workable.

From that simple beginning sprang the NORPLANT contraceptive, a project that would eventually involve thousands of individuals and scores of organizations. Some of the organizations that collaborated with the Population Council included the World Health Organization (WHO), the UN Family Planning Agency (UNFPA), and the International Planned Parenthood Federation (IPPF).

In 1965, Segal and a Chilean colleague, Dr Horacio Croxatto, began to study the idea of a contraceptive implant seriously. Within 2 years, they were able to proceed with testing on a group of 25 women — the first of many such test groups.

The capsules were still at the trial-and-error stage, with the dosages often too low to prevent pregnancy. There were several unplanned pregnancies but the volunteers remained undeterred.

There were other setbacks along the road. One of the more promising materials being tested, megestrol acetate, had to be withdrawn when its British manufacturer reported possible adverse effects in toxicity tests with

animals. Later, the development of a two-capsule version of the implant, known as NORPLANT II, had to be stopped when Dow Corning ceased manufacturing the material used to make the capsule. (A new version of NORPLANT II is currently undergoing trials.)

None of these problems, however, prevented the project from moving forward. By 1975, the Population Council had reached agreement with a commercial manufacturer, Leiras Pharmaceuticals of Finland. The implant was ready for large-scale international trials.

The first of these trials involved 1500 women in six different countries — Brazil, Chile, Denmark, Finland, Jamaica, and the Dominican Republic. Field testing of a contraceptive with a 5-year life span turned out to be a lengthy process, and it was 1980 before the next round of trials began.

This time the volunteers numbered in the tens of thousands of women. Eventually, more than 55,000 women in 44 countries participated in the NORPLANT tests, with developing countries representing a large number of test sites. The trials involved 12 countries in Latin and South America, 7 in sub-Saharan Africa, 3 in North Africa and the Middle East, and 13 in Asia. The United States and 8 countries in Europe also participated in the testing of the implant. The developing countries, many with serious population problems, had perhaps the most to gain from the tests.

The enormous task of organizing and tracking trials of this scale led the Council to another innovation: it created the first global computer database for the introduction of a contraceptive. This global database led to the increased involvement of other organizations like the Association for Voluntary Surgical Contraception (AVSC), Family Health International (FHI), and the Program for Appropriate Technology in Health (PATH). These groups also aided the Council in supervising the trials and preparing training materials for health workers.

An essential component of the project from the first trials was training. One of the disadvantages of the NORPLANT method is that the insertion of the capsules requires skilled medical personnel. Special centres had to be established around the world to provide training for the hundreds of personnel needed just to conduct the trials. By the time NORPLANT was ready to be introduced on a nation-wide scale, a 3-day training program was developed to provide the necessary clinical expertise.

Concern with the users, however, is perhaps the feature that makes the NORPLANT program truly unique. The tone was set by the president of the Population Council in 1966, when he said that "...important as it is to have a satisfactory method, it is equally important that women be given a real understanding of what they can expect."

A large part of IDRC's involvement with the project has been in funding studies of user satisfaction with the implants. Dr George Brown, a Council vice-president and a former director of IDRC's Health Sciences Division, is responsible for the NORPLANT introduction program. He says the IDRC-supported studies have been invaluable in obtaining a better understanding of the attitudes of the users.

Despite the modest success of NORPLANT to date and the increased international scientific cooperation, the question remains whether it was all worthwhile. The implant is still one of the more expensive contraceptive options available — roughly double the cost of the pill and 18 times the cost of an intrauterine device (IUD), according to one study. Was there really sufficient need for a new contraceptive to justify 25 years of effort and millions of dollars?

Dr Beverly Winikoff, a Council physician and public health specialist, says yes. "NORPLANT very definitely fills a need for a long-term method that doesn't require constant attention," she says. "It is a good alternative to sterilization and an

excellent way to space children. It works well for women who don't want any more children but still have a decade or two of reproductive potential ahead of them."

Based on United Nations projections, there could be as many as 639 million contraceptive users by the year 2000. Using these projections, it would be expected that there would be between 4–7 million NORPLANT users in developed countries and 15–25 million users in developing countries. In the future, NORPLANT promises to play a large role in birth control.

Winikoff adds that women still need more contraceptive choices to meet their changing requirements. The introduction of each new method increases the chances of reaching the millions of women who still do not use contraception, she says.

Despite these needs, the major pharmaceutical companies have virtually moved out of the field of contraceptive research. This is partly because of high costs and partly because of the fear of litigation should some unforeseen side-effect be discovered in a contraceptive product.

The task, then, falls to nonprofit organizations such as the Population Council to provide women with more choices for birth control. In this sense, the Council's initiation of the new NORPLANT contraceptive and its information cooperation may act as a stepping-stone for increased research into birth control and family planning.

By Bob Stanley.



Choice and Challenge: Global Teamwork in Developing A Contraceptive Implant", IDRC-278e, available from the Communications Division of IDRC, Ottawa, Canada.



Or write to: The Population Council, One Dag Hammarskjöld Plaza, New York, New York 10017, USA.

RAINWATER CATCHMENT SYSTEMS



Rainwater catchment systems use three main parts to collect rain for water supply: the catchment, the conveyor, and the storage tank. The catchment refers to the area where the rain falls and is collected. For reasons of convenience, sanitation, and cost, roofs are the obvious choice for collecting rainwater.

The conveyor for collected rainwater is a canal-like structure attached to the edge of a sloping roof. It directs the collected rainwater into the storage tank. These conveyors are also known as gutters or downspouts.

Ferrocement is a highly resilient, rust-proof material used in storage tanks. The tank itself may take a cylindrical, rectangular, or box-like shape and may be built above or under the ground. Although tanks may come in various designs or materials, ferrocement is becoming one of the more economical materials because it can last up to 30 years.

The Equipment

The following supplies are needed to build a ferrocement rainwater catchment system. For the storage tank, four bags of portland cement are required along with cleaned and washed sand. Wire mesh should be used to hold the cement in place. Other smaller parts like faucets are also needed.

For the catchment roofing materials, galvanized iron (GI) or aluminum sheets are recommended because they are lightweight and more durable. Cheaper alternative roofing materials include tiles, which can be produced locally. A tile roof, however, needs stronger structures for support because of its heavier weight. For reasons of contamination, painting or tar-coating tile roofs should be avoided. Thatched roofs, common in many areas, are not advisable for the same reason. Water is also likely to seep through, resulting in greater water loss.

As in the roof, metal, particularly tin, is the preferred material for conveyors. It is more durable and easier to maintain than other materials. Lower cost alternatives include hollowed out wood or bamboo. These materials are, however, prone to rotting and they need constant replacement. Split PVC or plastic pipes have also been used more recently in conveyors.

It takes, generally, about four workers 4 days to build a 4000 L tank, enough for a large family.

Is It Suitable For You?

There are a number of criteria for judging whether or not the rainwater cistern unit is appropriate for a certain area.

Rainwater tanks are most suitable in the following areas:

- Islands where salt intrusion contaminates groundwater and other sources of water.
- Areas where there is poor quality of river water or great distances between the user and the water source. Even in areas where there is a limited rainfall, the cistern system may still be more efficient.
- The Tropics, especially areas like the Philippines and Indonesia, where there is abundant yearly rainfall, but little or no rain during the dry season.

Determining Suitability

Before setting up a rainwater collection system it is important to measure some important factors, like the amount of rainfall and the demand for water. Some information must be gathered:

- The amount of monthly rainfall. Data on this can be obtained from national weather agencies or even from farmer's experiences. Data should stretch back over the past 10 years to determine the rainfall pattern.

- The total catchment area must be measured. The roof area must be measured to find out what percentage of rain will be caught.
- The loss factor, the amount of rainwater that does not go into the tank, must be figured into the calculations.
- The demand for water. This can be determined simply by counting the number of people who will use the water and by finding out their average daily use of water for various purposes — drinking, cooking, washing, etc.

Designing Tanks for Rainwater Storage

The amount of rainfall and the demand for water can be used to determine the appropriate design and size of the tank. In areas where rainfall is evenly distributed, a permanent tank that is large enough to hold a month's supply of water is sufficient.

In areas with distinct wet and dry seasons, characterized by periods of little or no rain for about 3 months, the size of the tank may be increased to store water for use in the dry season. Cost becomes a major factor in this case because tanks large enough to meet the needs of most individual families can become prohibitive.

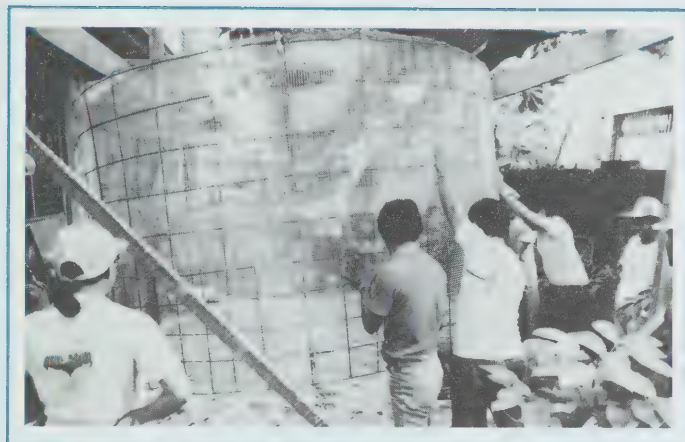
An alternative, therefore, in designing tanks is to consider water use of families only for the purposes of drinking and cooking. Water needs for bathing and washing can be found elsewhere.

Yet another option is to build smaller, nonpermanent tanks or jars to catch rain, like those found throughout Thailand.

Advantages of Rainwater

There are a number of advantages with rainwater collection:

- Better quality of water.
- Relative independence of system — appropriate for scattered or rural settlements.
- Availability of local materials for system.
- Relative simplicity of the technology.
- Easy maintenance.
- Easy accessibility and valuable time saved getting water supplies.



A ferrocement rainwater catchment tank under construction in the Philippines.

The Constraints

Cost is one of the main constraints of the rainwater system. Often a grant or low-interest loan is needed to help individual families shoulder the cost of constructing a rainwater tank.

Other Considerations

As it is often the poorer and harder to reach sectors of the population who are the target beneficiaries of safe water, their habits, attitudes, and sociocultural beliefs have to be considered:

- Because it is often women who are responsible for water in the community, they must be involved in every phase of the new rainwater system.
- How receptive are people to new technologies? For example, how willing would rural villagers be to change their thatched roofs to galvanized iron or metal roofs?
- Do they have the space to put up the tank?
- How receptive are people in the community to providing labour or repaying loans used for building the tank?
- Do the people have time to attend training?
- Are people willing to take responsibility for maintaining and cleaning the tanks on a regular basis?
- Are there groups, other than men, who can help build the tanks?
- Are there groups that would be willing to provide initial capital for this kind of endeavour?
- Acceptability of the technology by the people must be as important as its affordability and appropriateness.

A Case Study

In 1984, cylindrical ferrocement rainwater tanks were introduced to the Philippines. Previously, tanks were made of galvanized iron or fibreglass. These materials proved ineffective, however, as the iron was prone to rust and the fibreglass was too expensive for ordinary villagers. Ferrocement seemed like a logical alternative to cut costs and improve efficiency.

The ferrocement tanks were built in rural areas where the population was dispersed and roof surfaces were open enough to catch large amounts of rain.

A nongovernmental organization (NGO), called Capiz Development Foundation, worked with local governments to fund construction of these tanks in "pilot" projects.

The beneficiaries of the funding were screened in terms of their strong motivation to make the technology work. The volunteers expressed willingness to undergo training, provide labour, and repay the cost of the tank. Because these initial projects were so successful, ferrocement tanks have gained increasing acceptance as an excellent material for rainwater collection tanks.

By Teresita Bagasao, an NGO worker with Kabalikat in the Philippines.



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CEMENTING INFORMATION

The International Ferrocement Information Center (IFIC) collects, processes, and disseminates information on ferrocement and related materials, particularly for the benefit of developing countries. IFIC offers various information services, ranging from conducting ferrocement training and providing bibliographic computer searches to offering workshops and responding to technical queries.

The quarterly "Journal of Ferrocement" is the main communication tool of IFIC. But IFIC has a host of other publications benefiting its diverse clientele of academics, researchers, engineers, amateur builders, extension workers, development officers, and others.

IFIC offers services to those seeking information on how to solve specific problems in the field. IFIC consultants, 141 people in 39 countries, are individuals willing to share their field of expertise with others.

To transfer technology to the rural areas of developing countries, IFIC organizes training programs, seminars, study tours, conferences, and symposia. IFIC identifies needs, solicits funds, and brings experts and people together.

To accelerate the flow of information, IFIC established the Ferrocement Information Network (FIN) and the IFIC Reference Centers Network. A FIN pilot project, consisting of universities in Malaysia, the Philippines, India, Indonesia, and Saudi Arabia, was introduced in 1985 to aid in rural development. The IFIC Reference Center houses the basic ferrocement reference collection.



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BACK TO GHANA'S FUTURE



Kobina Amoah is having a hard time controlling his kids these days. Stuck thousands of miles away from their native land of Ghana, his children are anxious for familiar food, like *kenkey*, a Ghanaian staple made from maize. "I just tell them not to think about it," he says with a broad grin, almost hiding the fact that he too misses the traditional food.

Food and agriculture are, however, topics of more than just passing interest. Kobina Amoah is a researcher from the southern coast of Ghana, awarded a Pearson Fellowship from IDRC to study in Ottawa, Canada. The Fellowships are given to outstanding public servants in developing countries to improve their skills in public administration.

Amoah's main area of interest is public economic policy, particularly in the agricultural and food-crop sector.

He has spent almost a year in Canada, examining some of the barriers keeping Ghana's economy from sustainable development — barriers preventing the Ghanaian people from enjoying a better standard of living.

At the time of independence in 1957, Ghana's economy was considered quite advanced in the sub-Saharan African region, with one of the highest per-capita incomes in Africa. Booming cocoa exports, abundant land and labour resources, and low inflation showed signs of a bright future for the west African country.

"But not much has gone right for our economy since then," Amoah says. By the early 1980s, a combination of factors had caused Ghana's economy, which had been declining steadily for about

two decades, to collapse completely. In response to this crisis, a sweeping stabilization and adjustment program was launched in 1983, under the supervision of the International Monetary Fund and the World Bank.

Known as the Economic Recovery Program (ERP), it has shaped Ghana's economy for better or worse. Often held up by international institutions as a classic example of "adjustment with growth," Ghana's recovery has not been quite so smooth or complete.

In his research, Amoah has tried to find out what happened to the country's once-strong agricultural base. "One of the things I have discovered," he says, "is that much of Ghana's 'recovery' has been at the expense of the food-crop sector."

When in Ghana, Amoah works for the Ministry of

Amoah says it is up to the government to provide farmers "with the kind of inputs and credit they need when they need it. The main goal of my research is to see how we can improve the output in the food-crop sector."

A key objective of the ERP was to boost Ghana's lagging export sector; pumping US\$126 million into cocoa production. It has helped Ghana's export performance, but has it created more food and a better standard of living?

In terms of the food-crop sector, Amoah's unfortunate answer is no. "The trends and indicators in the food sector are not encouraging — they are going down," he says disappointedly. "The issue keeps coming up in my mind: should a nation keep on exporting so that it can import food to feed its people? It is a very odd and unpredictable

stimulating domestic agricultural production," he says. Acknowledging that the issue of domestic versus export-led development is complex, Amoah still does not want to see Ghana's food-crop production decline because of an over-dependence on exports.

"This dilemma of concentrating on either export products or agricultural crops for domestic consumption is larger than Ghana," he says, "it is the crisis of Africa."

Amoah remembers a time when there was very little crisis in his life. He talks animatedly about growing up in his small village, playing in "pick-up" soccer games and going to school.

School, to Amoah, has always been a way of improving himself and expanding his knowledge of Ghana and the world. He has a master's degree in development studies from the Institute of Social Studies in the Hague, Netherlands, and has also completed a course on public finance at the Royal Institute of Public Administration in London, England.

But it is his early schooldays in Ghana he remembers most. "I enjoyed school unlike many children, perhaps because education is quite different in Ghana. We are an outdoor people, often sitting and teaching outside on the grass. This is the way we work, too."

Amoah says getting used to the "purely official" nature of work in an industrialized country was a challenge. "Back in Ghana, the person you sit beside is not just a colleague — usually he or she is a friend. In Canada, I barely know who lives next door to me in my apartment," he says with a shrug.

"Sometimes, it can get lonely, but I just keep thinking how important my work is to my country."

Finance and Economic Planning, where he has been a senior planning officer since 1983. He thinks he can ask the questions that need to be answered in the economy's food-production sector.

"We have to look at educating the farmers toward a greater acceptance of new, more efficient methods of farming. Irrigation systems, for example, are still quite unpopular with Ghanaian people."

way to feed our population."

What disturbs Amoah most is that many farmers are switching from food to export production because of the higher producer prices for cash crops. The incentive is there to make more of a profit, he says, but will that profit translate into more food for more people?

Amoah thinks it is time for Ghana and the donor institutions to place a greater priority on the agricultural sector. "We have to put more development funds toward



Kobina Amoah, in his temporary home of Ottawa, Canada.

Getting used to this formality is only one of many adjustments Amoah has made in coming to a different country to do research. He had to leave his wife and two of his children in Ghana. Amoah's other two children live with him in Canada. "Sometimes, it can get lonely, but I just keep thinking how important my work is to my country," he says.

Surviving a cold Canadian winter ranks high among his personal triumphs. Despite his desire to return to Ghana's warm weather, Amoah knows that his country can have serious climatic problems. "We have a dry and rainy season," he says, "droughts have been a recurrent problem in our history." Indeed, it was a severe drought in the early 1980s that pushed Ghana's economy and agriculture to the brink of collapse.

Amoah feels the drought is often overlooked by international organizations bent on blaming Ghana's economic problems on poor domestic policies. "You can isolate domestic policy failures, but only up to a

point," he says. "Unstoppable forces like the drought, a collapsing world commodity market, or the repatriation of a million Nigerians to Ghana are just as, if not more, important reasons for our economic decline."

The diverse reasons for economic problems and the uniqueness of Ghana itself are, he says, often put aside by large financial institutions setting up hundreds of programs in developing countries. Amoah clearly remembers sitting in on some of the negotiations between the Ghanaian government and the World Bank.

"Often, the intent of the adjustment program is good but the officials do not know the culture. It seems as if they had read about our country in a book. Some people in our country call these international officials 'helicopter consultants' because they only see things from high above and then quickly leave. Perhaps, they should place more emphasis on local expertise."

The need for more understanding on a country-by-country basis is the crux of international development, Amoah says. "Developed countries have to look at developing countries individually — the motivation for foreign assistance has to come from a humanitarian basis, a respect for that particular country's well-being."

Amoah thinks that "too many times foreign aid is linked to beneficial trade patterns or even arms deals. If we are to look at international development seriously, we have to question and reevaluate the motivation behind foreign assistance schemes."

Amoah looks at Ghana's problems from the ground up. He has no choice. He lived through the economic crisis and now hopes to return to his country with a fresh perspective and an enthusiasm for helping the economy recover properly and evenly.

Amoah wants to apply himself to the task of aiding Ghana's economic and agricultural recovery as quickly as possible. But this may just have to wait until he and his children can have some time to enjoy a piece of *kenkey*.

By Craig Harris.

BEYOND CATCH PHRASES: WHAT DOES SUSTAINABLE DEVELOPMENT REALLY MEAN?



David Brooks



"Sustainable development is development that meets the needs of

the present without compromising the ability of future generations to meet their own needs" — Our Common Future (the Brundtland Report).

This is the concise definition of sustainable development offered in what is arguably the most important document of the second half of the century. In many ways, the Brundtland Report is important not so much for what it says, but for the reaction it has stimulated.

It has had a galvanizing effect on international development at a crucial time. It made sustainable development a political issue by the very fact that it was a consensus document — not just from the East and West but also from the North and South.

Clearly, the Brundtland Report achieved its purpose: it got people talking about sustainable development. As a result, we have had a burst of analyses and articles about what we are doing and where we are going in both developed and developing

countries. Indeed, sustainable development has become official policy in dozens of organizations around the world, most notably the World Bank.

All of this, and yet few people can offer a good explanation of what sustainable development really means. As always, confusion and misunderstanding are frequent side-effects of lofty proposals on environment and economic development.

The Brundtland Report must take at least some responsibility for the confusion, for its own definition is ambiguous.

Its definition is not new, clear, nor is it really complete. The authors have turned out to be their own worst enemies — they failed to draw out the implications of their own statements. Simply put, the authors want to have their cake and eat it too.

Sustainable development is a fundamentally radical notion that we must learn to use in all of our work. But, at the same time, it is conservative in that it can work within the traditional framework of economic theory. It is an alternative economics not an alternative to economics.

Sustainable development does not mean economics should be ignored, simply looked at from a significantly different perspective. It contradicts many common ideas about economic growth — but it does not say, in a knee-jerk fashion, that all economic growth is bad.

The inability to understand what sustainable development means has led to its mistaken acceptance by many organizations. Those using it as a standard often do not comprehend its implications.

Some Misconceptions — and a Better Definition

Because misconceptions surround the term sustainable development, a few clarifiers should be kept in mind. The adjective is "sustainable" not "sustained." The noun is "development" not "growth" and the word "economic" does not appear.

Although these distinctions may appear simplistic, they are important. Growth, for instance, means to increase in size by adding material. Development, on the other hand, is the realization of potential.

Many people use the term "sustainable growth" but it is a contradiction in terms. Sustainable refers to limits whereas growth means physical increase — the two concepts do not mix. Sustainable development, however, means limits placed on potential — quality can always be expanded, and in many more ways than mere physical size.

A better understanding of the idea of sustainable development can be found in a report by the World Conservation Strategy, which actually predated the Brundtland Report:

"The emerging paradigm of sustainable development... seeks to develop strategies and tools to respond to five broad requirements:

- Integration of conservation and development.

- Satisfaction of basic human needs.
- Achievement of equity and social justice.
- Provision for social self-determination and cultural diversity.
- Maintenance of ecological integrity.

These challenges are so strongly interrelated that it is difficult, and indeed unhelpful, to arrange them in hierarchical or priority order. Each is both a goal itself and a prerequisite to the achievement of the others."

This definition of sustainable development is better than that of the Brundtland Report because it does not rely on one specific axis for explanation. It points to the many implications and interconnected aspects inherent within the term sustainable development. It also confronts the incorrect notion that environmentalists are not interested in people.

Where Are We Now? Sustainable Development as a Microconcept

Environmentalism has made significant gains at the individual project level. New tools such as "environmental and social impact assessments" can indicate to what degree economic activity affects the environment. These tools allow for the fact that the environment serves as a repository for waste as well as a source of materials for production. They also show an increased recognition of the aesthetic value of nature and its resources.

*"It is an
alternative
economics not
an alternative
to economics."*

There is a growing recognition that, in many cases, bad economics is bad environment. Getting price signals right and getting rid of subsidies for vested interests may be the best thing for the environment.

But all of these gradual observations share the same philosophy: the present economic system is fine; we just have to fine tune it. We can continue to do what we are now doing, just do it better. But this is ignoring the key issue of sustainable development — the macroperspective.

**Going Deeper:
Sustainable
Development as a
Macroconcept**

Sustainable development is not fundamentally about microeconomics or individual project analysis. It instead must focus on the big picture, macroeconomics and policy analysis. The key issues do not involve questions of how — how to allocate resources — but how much — the size of the economy. We have to look at how many people can live on this earth and, more important, how rich they can be in terms of their use of natural resources.

Traditionally, macroeconomics has within it no concept of the maximum size of an economy. There are no restrictions on the scale of an economy; bigger is always better.

But the environment imposes very real constraints on the size of an economic system. Human activity has pushed against the physical limits of the world. We are beginning to go beyond a scale at which we can comfortably survive. The problems of global warming and rising sea levels are only the most visible example of going beyond our limits.

Economic textbooks have emphasized the circular flow of income through a capitalist economy — the greater the flow the larger, and thus more prosperous, economy. But the inability, or unwillingness, to realize that economies must be limited in scale has pushed us back against a wall.

Sustainable development suggests an alternative perspective. Instead of focusing on a circular flow of income, we should be looking at a linear flow of natural resources — the depletion or degradation of resources caused by human use. By moderating this linear flow, we can go far toward ensuring that resources, whether renewable or nonrenewable, will be available for the future.

Some think the limitations of our environment can be offset by technology or by recycling. They can, but only partially. Technology and recycling can graft on new solutions without addressing the root of the problem: the mentality that an economy can grow indefinitely.

To address the problem, most environmental economists have concluded that, just as we need ethical criteria to help determine the distribution of income in an economy, so too do we need ecological criteria to help us determine appropriate limits to the scale of an economy.

One of the foremost alternative economists, Herman Daly of the World Bank, prefers this approach. He argues that there is a fundamental difference between quality development and growth. An economy, he believes, should be efficient enough to ensure quality development. But growth in the scale of that economy must become increasingly constrained by the capacity of the ecosystem to regenerate natural resources and absorb waste outputs. Growth, in other words, must be limited by the environment.

**Sustainable
Development and the
Third World**

We are still learning how to introduce these notions of sustainable development into larger economic considerations. Thus, it is too early to state categorically how it might apply to developing countries. However, we can suggest that the introduction of the concept will have four important benefits.

First, sustainable development will force both economists and ecologists to look much more carefully at their models and their

definitions. Many things previously on the fringe of economic theory, such as the concept of entropy, will now rightfully move toward the centre.

Second, we will get some specific tools to measure the effects of human activity on the environment. Economic indicators, such as gross national product, will come to include the depletion of natural resources and their degradation through pollution.

The third benefit, and most relevant to international development agencies, is the introduction of sustainable development as a set of criteria into both project analyses and reviews of wider policy choices. We are a long way from having a full set of criteria — economic, social, cultural, and ecological — but the ground is being laid.

Fourth, and maybe most important in the long run, sustainable development is on its way to becoming a philosophical concept that will infuse all work on development, whether in richer or poorer countries. If it is accepted seriously, apparent rates of return on a nonsustainable proposal are simply irrelevant when compared to a proposal that has a lower yield but is sustainable. Whether or not a project is "sustainable" will become the standard of success in international development.

*By David Brooks, Associate
Director, Environmental
Policy, IDRC, Ottawa.*

REPORTS

I N B R I E F



Pulmonary Pesticide

A Colombian researcher has shown that there is a link between high exposure to paraquat and chronic, irreversible lung disease. Paraquat has been used as a herbicide to control weeds for more than 30 years, mainly in developing countries.

Dr Maria Elena Arroyave, currently a postgraduate student at Canada's McGill University, conducted her study in an agricultural region of Colombia where the use of paraquat is common. The findings of high levels of pulmonary obstructive disease among those working with paraquat reveal its dangerous side-effects, she said. People using the herbicide have up to seven-and-a-half times greater risk of getting chronic lung disease, according to the study.

The IDRC study also suggests that acceptance limits for paraquat exposure set by international organizations like the World Health Organization (WHO) are not stringent enough.

Communicating About Condoms

In Nigeria, the condom — a key factor in preventing the transmission of AIDS — is accepted by very few people.

A fertility survey in 1982 showed that only 5.6% of respondents had heard of the condom, whereas only 0.8% had ever used the contraceptive.

To try to reverse this situation, an IDRC project called "Condom Acceptability and Use in Nigeria" was organized in 1988 to study the attitudes of sexually active Nigerians. Using 2250 persons drawn from three urban and three rural communities, the

study has identified some of the social, religious, economic, psychological, and cultural factors that determine the acceptability of condoms.

The project was set up through the Department of Sociology and Anthropology at the University of Nigeria.

Spoiling the Soil

India's soil is becoming unarable at a rapid pace. In search of food, fodder, and fuel, India's 800 million people and 400 million livestock have exhausted more than 100 million ha of once-productive land. Another 160 million ha of land are under cultivation, left only marginally productive and in various stages of degradation.

To combat the problem, the Indian Council of Agricultural Research is integrating agroforestry methods into farming. They hope to restore fertility to much of the land.

The IDRC-sponsored project, "Agroforestry in India," is designed to reduce the erosion that results when agricultural land is degraded. Erosion often leads to siltation and floods.

The project was started in 1989 through the National Research Centre in Agroforestry in Jhansi, India.

"Steppeing" Forward

The vast spaces of the Maghreb steppe, which have long contributed to food production in Algeria, Morocco, and Tunisia, currently face serious threats of environmental degradation. Nomadic people, who have recently begun to settle permanently in these areas, are experiencing hardships because of the privatization of collective lands and the use of inefficient agricultural methods.

Three IDRC-sponsored projects, known as "Pastoral Systems of the Maghreb," have been set up in these countries to test more productive forms of agriculture and livestock management. The projects, introduced in 1989, are involving the people of the steppes in the selection, implementation, and evaluation of better methods of farming and animal raising.

Tanzania's Economic Troubles

Tanzania is still suffering from an economic crisis brought on by external shocks and poor domestic policies. A well-conceived economic model could help national economists better understand the way the economy functions and what policies will most likely improve performance.

IDRC, in collaboration with the University of Toronto's Department of Economics, is working with Tanzanian economists on the second phase of the project "Macroeconomic Management in Tanzania." Researchers hope to generate a model for policy decisions.

A previous phase of this project created an acceptable model, but it was not used to make decisions within the Tanzanian economy. The economy has gone through some important changes since 1984, the end of the initial phase, and researchers hope to integrate them into an accurate model for making efficient policies.

Weeding Out the Problem

Weeds are increasingly recognized as one of the major causes of low crop yields throughout the world. Extensive research on weeds has produced a wealth of

information on weed biology, herbicide chemistry, and control and management schedules of weeds in various crop systems.

But one of the problems remains consolidating this information and providing it to those who need it most — farmers, fieldworkers, and scientists. The Southeast Asian Weed Information Center (SEAWIC) is dedicated to getting information about weeds across to the public. IDRC has sponsored a project in which SEAWIC will focus on the information needs of extension workers, fieldworkers, and farmers.

SEAWIC's address is: *Southeast Asian Weed Information Center, PO Box 17, Bogor 106001, Indonesia. Telex: 48299 BIOTRO IA.*

Simple Water Tests

Drinking water sources in most rural areas of the world remain untested because of the cost of conventional methods for assessing water quality.

But, for the past 6 years, IDRC has supported research in the development of simpler and cheaper tests. Researchers from Brazil, Chile, Egypt, Malaysia, Morocco, Peru, Singapore, and Thailand have examined a number of promising nontraditional microbiological water tests and have adapted them to their particular needs.

A final report of this research is available from IDRC's Communications Division. It is called *"Use of Simple, Inexpensive Microbial Water Quality Tests: Results of a Three-Continent, Eight-Country Research Project."* Its reference number is MR-247e.

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IDRC AT TWENTY

AN ANNIVERSARY OF DEVELOPMENT

The international exposition in Montreal, Expo '67, was one of Canada's first opportunities to play host to the world. The international flavour that surrounded this event led Canada to a much more permanent relationship with several countries.

It was during this exhibition that Canada's then Prime Minister, Lester B. Pearson, spoke before the Canadian Political Science Association, planting the seed of what was to become the International Development Research Centre (IDRC). "The challenge of international development," he said, "is to find new instruments for concentrating more attention and resources to the solution of man's economic and social problems on a global basis."

Shortly after this speech, one of these "new instruments" was forged. In 1970, the International Development Research Centre was created through an Act of the Canadian Parliament.

The many proposals for an international research centre came together in the idea that it was to be a place for learning where the latest knowledge would be made accessible to developing countries.

IDRC's uniqueness in international development can be found in its insistence that research be done, whenever possible, in developing countries. A primary goal is the transfer of learning. This transfer has become crucial in the age of technology where indigenous research and modern science possess the tools of social and economic advancement.

A characteristic of IDRC that has helped shape this uniqueness is the organization of the institution itself. An independent, international Board of Governors

makes policies and outlines the directions IDRC should take. The Board consists of 11 Canadians and 10 representatives from both developed and developing countries.

Since its inception, IDRC has operated on the belief that its most appropriate role is in responding to the problems and opportunities of development by supporting indigenous enterprise. Sensitivity, responsiveness, and respect have guided IDRC in its willingness to let countries develop on their own terms.

This principle has stood the test of time. It is just as valuable, perhaps more valuable, today as it was 20 years ago.

In the complex world of international development, IDRC remains observant of areas where it can exploit its comparative advantage to the full. Two major aspects of this advantage are its source of knowledge about developmental research and its ability to change directions to serve the needs of developing countries better.

An example of IDRC's flexibility was the decision to direct more resources to meet the needs of African research. It has increased the percentage of total resources flowing to sub-Saharan Africa and the number of program staff based in the regional offices of Dakar and Nairobi.

To ensure that IDRC meets the needs of African researchers, it has prepared a strategic plan to guide activities in the region. It was distributed widely, and comments were received from hundreds of African policymakers and researchers. This strategic plan is being modified so that IDRC policies truly reflect the priorities of African researchers.

In just 20 years, this institution of modest means has attracted worldwide attention. Other donor centres have shown an interest in the IDRC approach and value IDRC's experience.

Praise for IDRC has come from a number of sources. The Organisation for Economic Co-operation and Development (OECD) has called it "the premier organization in the world tackling one of the most critical problems of our time."

In 1988, IDRC became the recipient of the first ever "Twenty-First Century Award" given by the prestigious United States Scientific Research Society, Sigma Xi. This group said IDRC's "perceptive, imaginative, and generous *modus operandi* has profound implications for the stability and well-being of the interdependent world of the 21st Century."

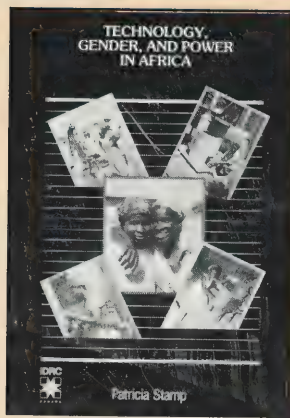
IDRC is celebrating with pride its 20th anniversary. Much has yet to be done. Although its resources are modest, the dedication of IDRC is unlimited.



Ivan L. Head
President, IDRC



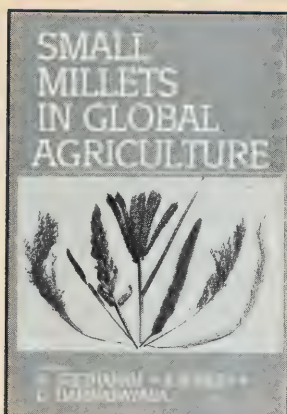
20
YEARS
OF DEVELOPMENT
THROUGH RESEARCH



"Technology, Gender, and Power in Africa"
by Patricia Stamp
IDRC TS-63e

This book demonstrates that the study of gender relations and the power of women is central to an evaluation of development efforts in Africa. Case studies and examples are used to explore such topics as agriculture, health and nutrition, and feminist scholarship. The book seeks to analyze how women can gain social, economic, and technical empowerment at the community level to aid development efforts.

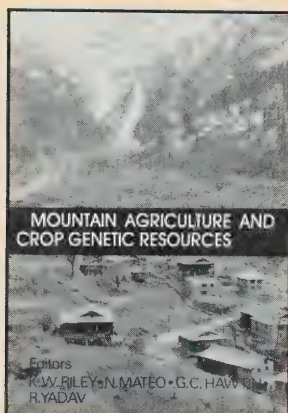
Published by the International Development Research Centre, PO Box 8500, Ottawa, Canada, K1G 3H9.



"Small Millets in Global Agriculture"
by A. Seetharam, K.W. Riley,
and G. Harinarayana

This book stems from the International Workshop on Small Millets held in India in 1986. It is a response to the need for more research into traditional groups of cereal crops, like small millets. In many parts of the world, these traditional crops play an important role in maintaining stable and sustainable forms of agriculture. This study looks at production trends, genetic resources, breeding, cropping systems, production technology, physiology, and food and forage uses of such millets as barnyard millet and teff.

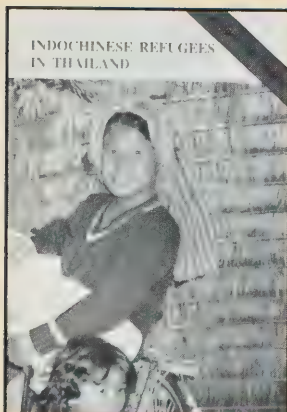
Published by Moban Pramlani for Oxford & IBH Publishing Co. Pvt Ltd, 66 Janpath, New Delhi, 110001.



"Mountain Agriculture and Crop Genetic Resources"
by G.C. Hawtin, N. Mateo,
K.W. Riley, and R. Yadav
(editors)

This book is based on the International Workshop on Mountain Agriculture and Crop Genetic Resources held in Nepal in 1987. The workshop examined the complex and unique mountain environment for crop varieties. The study analyzes the physical features and the farming systems in the Andean, Himalayan, and Ethiopian mountain regions. It also describes the crop genetic resources and compares the aspects of highland agriculture in these three areas.

Published by Moban Pramlani for Oxford & IBH Publishing Co. Pvt Ltd, 66 Janpath, New Delhi, 110001.



"Indochinese Refugees in Thailand: Prospects for Longstayers"

Since 1975, Thailand has had to face refugee problems from various countries, particularly Cambodia, Laos, and South Vietnam. As a developing and first-asylum country, Thailand has been forced to shoulder a political, economic, social, and humanitarian burden — the dilemma appears to be endless until peace returns to Indochina. This book surveys some selected problem areas with regard to refugees arriving in Thailand from Indochina.

Published by The Public Affairs Foundation, PO Box 11-1136, Bangkok 10110, Thailand.

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